Coatbridge High School

Mathematics Department

## Homework Booklet

CfE Level 4

Exercise 1

1. For each of the following tolerances, write down the minimum and maximum allowable sizes :-

   (a) (10 ± 1) cm   (b) (15 ± 2) mm   (c) (100 ± 4) kg   (d) (250 ± 20) km

   (e) (12 ± 0.2) cm   (f) (3 ± 0.1) m   (g) (5.5 ± 0.2) g   (h) (0.5 ± 0.01) cm

2. A joiner needs a type of wood screw with length (25 ± 2) mm to complete a cabinet.

   (a) Write down the min. and max. length the joiner requires.

   (b) State which of these wood screws he can use for the cabinet.

Type A	Type B	Type C	Type D	Type E
26 mm	27 mm	28 mm	22 mm	23 mm
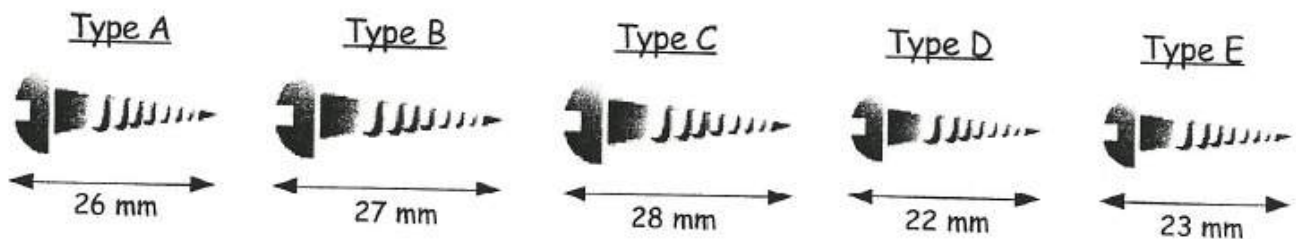
3. The spark plug gap for a Rover car is (1.00 ± 0.05) mm.

   (a) Write the minimum and maximum distance for the gap.

   (b) State which of these gaps is <u>not</u> acceptable.

   (i)   1.03 mm   (ii) 1.1 mm   (iii) 1.04 mm

   (iv) 0.6 mm   (v)   0.9 mm   (vi) 0.99 mm.
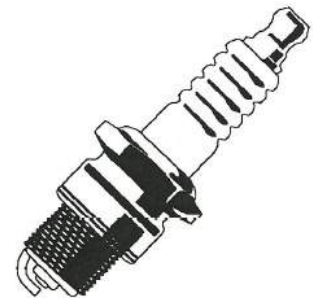
Exercise 2

1. Write each of the following in tolerance form :-

   (a) min = 20 m   (b) min = 150 cm   (c) min = 15 kg   (d) min = 100 mm
       max = 22 m   max = 160 cm   max = 16 kg   max = 106 mm

   (e) min = 5 g   (f) min = 0.5 ml   (g) min = 0.1 cm   (h) min = 10 cm
       max = 5.2 g   max = 0.7 ml   max = 0.12 cm   max = 10.01 cm.

2. A car has its idle speed set at a minimum of 775 revs/min and a maximum of 875 revs/min. Write this in tolerance form.

3. The dosage of a special vaccine must be between 5.3 ml and 5.4 ml. Write this in tolerance form.

4. The temperature in Majorca one day ranged from a minimum of 68°F to a maximum of 102°F. Write this in tolerance form.

Exercise 1

1. Round these numbers to the number of decimal places shown in the brackets :-

   (a) 5·13 (1)   (b) 7·851 (1)   (c) 8·736 (2)   (d) 6·3492 (2)

   (e) 4·8912 (3)   (f) 3·2915 (3)   (g) 47·999 24 (3) (h) 3·999 88 (3).

2. Use your calculator to do the following and give your answer correct to 2 decimal places :-

   (a) 4·36 + 6·447   (b) 23·82 × 16·35   (c) 37·1 ÷ 68·3   (d) 16 ÷ 7.

3. Do these calculations and round your answer to the number of decimal places shown in the brackets :-

   (a) 2·58 × 0·247 (3)   (b) 0·394 × 6·555 (2)   (c) 6·274 × 1·983 (3)

   (d) 0·58 ÷ 3·267 (3)   (e) 16·27 ÷ 19·443 (1)   (f) 0·7 × 0·19 × 0·87 (4).

Exercise 2

1. Write down the answers to each of the following :-

   (a) 3 – 5   (b) (–3) – 6   (c) (–12) – 5   (d) 4 – 8 – 7

   (e) (–10) – 3   (f) (–3·2) + 1·6   (g) 5·7 + (–8·8)   (h) (–7) + (–8) + 9

   (i) (–3) + (–2)   (j) (–3·1) + (–6·7)   (k) (–7·8) + (–6·8)   (l) (–3·1) + 4·2 + (–2·7)

2. Find :-

   (a) 2 – (–3)   (b) 4 – (–5)   (c) 7 – (–7)   (d) 14 – (–8)

   (e) –1 – (–2)   (f) –3 – (–7)   (g) –5 – (–16)   (h) –17 – (–18)

   (i) –3 – (–48)   (j) –7 – (–25)   (k) –1·7 – (–2·6)   (l) –3·8 – (–7·7)

3. Find :-

   (a) 30 ÷ (–3)   (b) 54 ÷ (–6)   (c) 80 ÷ (–4)   (d) 36 ÷ (–6)

   (e) 84 ÷ (–3)   (f) 225 ÷ (–25)   (g) 74 ÷ (–37)   (h) 30 ÷ (–4)

4. Calculate :-

   (a) (–3) × (–4)   (b) (–5) × (–5)   (c) (–7) × (–2)   (d) (–7) × (–12)

   (e) (–15) × (–4)   (f) (–8) × (–12)   (g) (–50) × (–20)   (h) (–100) × (–30)

   (i) (–6) ÷ (–2)   (j) (–9) ÷ (–3)   (k) (–16) ÷ (–4)   (l) (–1000) ÷ (–50)

5. Find :-

    (a) $(3 \times (-6)) \div 2$ (b) $((-3) \times (-4)) \div 6$ (c) $((-6) \times (-4)) \div 12$ (d) $((-4) + (-6)) \div 2$

    (e) $(5 - (-5)) \times 4$ (f) $((-6) + (-6)) \div 4$ (g) $(-8) \times (4 - 6)$ (h) $((-3) - (-9)) \div (-2)$

    (i) $(-4)^3$ (j) $(-2)^2 + (-1)^2$ (k) $(-5)^3 - (-3)^4$ (l) $(-2)^5 - (-2)^3$

Exercise 3

1. Write down the answers to :-

    (a) 6×0.3 (b) 8×0.9 (c) 15×0.4 (d) 0.6×250

    (e) 60×0.5 (f) 0.9×90 (g) 0.9×600 (h) 7000×0.3.

2. Find :-

    (a) $6 \times (-0.8)$ (b) $8 \times (-0.8)$ (c) $0.6 \times (-3)$ (d) $0.7 \times (-8)$

    (e) $15 \times (-0.4)$ (f) $(-25) \times (-0.9)$ (g) $(-0.5) \times (-120)$ (h) $(-0.7) \times (-90)$.

3. Calculate :-

    (a) $4.6 \div 2$ (b) $7.5 \div 5$ (c) $4.8 \div 8$ (d) $7.2 \div 9$

    (e) $18 \div 30$ (f) $42 \div 60$ (g) $64 \div 80$ (h) $45 \div 90$

    (i) $540 \div 600$ (j) $350 \div 500$ (k) $630 \div 900$ (l) $490 \div 700$

4. Find :-

    (a) $(-7.4) \div 2$ (b) $6.5 \div (-5)$ (c) $7.2 \div (-8)$ (d) $(-6.3) \div 9$

    (e) $28 \div (-40)$ (f) $72 \div (-90)$ (g) $(-54) \div 60$ (h) $(-2.8) \div (-700)$.

Exercise 4

1. Calculate :-

    (a) 0.8×6 (b) 0.8×60 (c) 0.8×600 (d) 0.8×6000

    (e) 0.8×0.6 (f) 0.08×0.6 (g) 0.008×0.6 (h) 0.0008×0.6

    (i) $(0.7)^2$ (j) 0.09×0.3 (k) 0.03×0.3 (l) 0.006×0.7

    (m) $0.08 \times 30\,000$ (n) 400×0.0005 (o) $0.3 \times 0.4 \times 0.5$ (p) $20 \times 0.8 \times 0.6$

    (q) $60 \times 0.1 \times 700$ (r) $0.8 \times 50 \times 0.8$ (s) $0.7 \times 500 \times 0.3$ (t) $0.6 \times 5000 \times 0.4$.

2. Try these trickier examples :-

    (a) 0.03×0.03 (b) 0.06×0.07 (c) 0.08×0.09 (d) 0.05×0.04

    (e) $(-0.8) \times 0.7$ (f) $0.02 \times (-0.04)$ (g) $(-0.08) \times (-0.01)$ (h) 0.009×0.003.

3. Find :-

    (a) $6 \div 0.3$ (b) $36 \div 0.9$ (c) $100 \div 0.4$ (d) $2.4 \div 0.8$

    (e) $4.55 \div 0.5$ (f) $22.33 \div 0.7$ (g) $6 \div 0.03$ (h) $5.2 \div 0.04$

    (i) $0.54 \div 0.006$ (j) $0.045 \div 0.009$ (k) $0.0174 \div 0.003$ (l) $12 \div 20$

(m) $45 \div 500$ (n) $56 \div 7000$ (o) $720 \div 8000$ (p) $350 \div 5000$.

4.   Have a go at these :-

   (a) $20 \div 0.0004$ (b) $(-0.54) \div 0.3$ (c) $(-0.72) \div (-0.8)$ (d) $(-0.007) \div (-0.07)$.

Exercise 5

1.   How many significant figures are there in each of these numbers :-

   (a) 62·0   (b) 3·00   (c) 1·009   (d) 40·7

   (e) 26·30   (f) 0·741   (g) 0·027   (h) 0·000 90 ?

2.   Round each number to 1 significant figure :-

   (a) 53   (b) 2679   (c) 0·251   (d) 0·000 815.

3.   Round each number to 2 significant figures :-

   (a) 308   (b) 5229   (c) 48·55   (d) 0·003 281.

4.   Round each number to 3 significant figures :-

   (a) 9812   (b) 72 091   (c) 0·287 45   (d) 0·019 999.

5.   What is the total volume, (in ml), of 25 bottles of juice, each containing 675 ml ?
      (Give your answer in millilitres to 3 significant figures)

6.   Harriet's restaurant bill came to £86·33 + VAT at 17·5%.
      Calculate the VAT in £'s, correct to 4 sig. fig.

7.   A jar of jam weighs 0·345 kg.
      Round the weight to 2 sig. figs. and **estimate** the total weight of 200 jars.

MNU 4-03b: I have investigated how introducing brackets to an expression can change the emphasis and can demonstrate my understanding by using the correct order of operations when carrying out calculations

Exercise 1

1. Find the value of each expression below when $a = 2$, $b = 3$ and $c = 4$:-

   (a) $a + b - c$ (b) $2a + 4b - 3c$ (c) $5b - 4c + a$

   (d) $a^2 + b^2 + c^2$ (e) $(c - a)^2 - 2b$ (f) $a^3 - (b - c)^3$.

2. Find the value of each expression below when $x = -1$, $y = 5$ and $z = -2$:-

(a) $x + y + z$ 　　　　(b) $3x + 4y - 3z$ 　　　　(c) $x^2 + (y - z)^2$.

3. Find the value of each expression when $a = -1$, $b = 2$, $c = 3$, $d = 4$ and $e = -2$:-

(a) $b + c + e$ 　　(b) $ab + cd$ 　　(c) $2b + 3c - 4e$ 　　(d) $abcde \div 4$

(e) $a^2 + b^2 + c^2$ 　(f) $a^2 - b^2$ 　　(g) $(ab + cd)^2 - e^2$ 　(h) $\sqrt{(ae)^2 - c}$.

MNU 4-06a: I have developed my understanding of the relationship between powers and roots and can carry out calculations mentally or using technology to evaluate whole number powers and roots, of any appropriate number.

Exercise 1

1. Find :-

(a) 3^2 　　　(b) 5^2 　　　(c) 2^2 　　　(d) 1^2 　　　(e) 10^2

(f) 9^2 　　　(g) 11^2 　　　(h) 12^2 　　　(i) 20^2 　　　(j) 100^2

(k) $(\frac{1}{2})^2$ 　(l) $(\frac{1}{3})^2$ 　(m) $(\frac{1}{5})^2$ 　(n) $(0.1)^2$ 　(o) $(0.01)^2$.

2. Find :-

(a) 2^3 　　　　(b) 2^5 　　　　(c) 3^4 　　　　(d) 8^2
(e) 9^1 　　　　(f) 1^{15} 　　　(g) 10^5 　　　(h) five squared.

3. Find the difference between :-

(a) 3^2 and 2^3 　　(b) 2^7 and 2^6 　　(c) 5^3 and 4^3 　　(d) 1^9 and 1^8.

4. Find the value of b^4 when :-

(a) $b = 2$ 　　　(b) $b = 3$ 　　　(c) $b = 10$ 　　　(d) $b = 0$.

5. Find :-

(a) $\sqrt{36}$ 　(b) $\sqrt{25}$ 　(c) $\sqrt{100}$ 　(d) $\sqrt{169}$ 　(e) $\sqrt{4}$

(f) $\sqrt{225}$ 　(g) $\sqrt{10000}$ 　(h) $\sqrt{900}$ 　(i) $\sqrt{1600}$ 　(j) $\sqrt{1}$.

6. Use a calculator and write down to two decimal places :-

(a) $\sqrt{20}$ 　(b) $\sqrt{50}$ 　(c) $\sqrt{56}$ 　(d) $\sqrt{179}$ 　(e) $\sqrt{14.4}$.

7. Calculate the length of the side of a square with area :-

(a) 49 cm² 　(b) 81 cm² 　(c) 9 m² 　(d) 1 mm² 　(e) 0.25 m².

Exercise 1

1. Write the following numbers in scientific notation :-

   (a) 4800　　　　　　　(b) 6780　　　　　　　(c) 31 000

   (d) 35 200　　　　　　(e) 54 350　　　　　　(f) 970 000

   (g) 487 000　　　　　 (h) 109 100　　　　　 (i) 4 400 000.

2. Write out each of the following in full, then write each in scientific notation :-

   (a) 7 million = 7 000 000 = $7.0 \times 10^{....}$

   (b) 2·5 million　　　(c) 9·19 million　　　(d) $4\frac{1}{2}$ million

   (e) 17 million　　　 (f) 27 million　　　　(g) 2·8 million

   (h) 1·97 million　　 (i) $12\frac{1}{2}$ million　　 (j) $15\frac{1}{2}$ million

3. This table gives the areas of various stretches of water throughout the world. Write each of the areas in scientific notation.

Sea / Ocean	Area (km^2)
Pacific Ocean	165 380 000
Atlantic Ocean	82 ·21 million
Indian Ocean	73·6 million
Mediterranean	2 510 000
River Clyde	2 130
Loch Ness	56
English Channel	103 600

   Nessie ?

4. A golf caddie earns £250 000 per annum.

   Write his earnings in scientific notation.

5. The population of Canada in May 2004 was 31 million and 629 thousand.

   Write this number in scientific notation.

Exercise 2

1. Change each of the following from scientific notation to number form :-

    (a) $3 \cdot 8 \times 10^4$ (b) $7 \cdot 5 \times 10^2$ (c) $3 \cdot 24 \times 10^5$ (d) $6 \cdot 47 \times 10^3$

    (e) $1 \cdot 478 \times 10^4$ (f) 3×10^1 (g) 9×10^6 (h) $2 \cdot 9 \times 10^6$

    (i) $6 \cdot 014 \times 10^4$ (j) 7×10^7 (k) $5 \cdot 37 \times 10^7$ (l) $8 \cdot 888 \times 10^8$.

2. This table shows the transfer fee paid for five football players (correct up to August 2012).

    Write each transfer fee out in full.

Player	Transfer Fee
F. Torres	£5 x 10^7
C. Ronaldo	€9.39 x 10^7
W. Rooney	£2.56 x 10^7
M. Balotelli	£1.754 x 10^7
V. Wanyama	£9.68 x 10^5

3. Rewrite this passage replacing each number with scientific notation.

    " Light travels 6 000 000 000 000 miles in a year.
    We call this distance a light year.
    Our galaxy, the Milky Way is 100 000 light years across and our sun
    is 30 000 light years from its centre."

Exercise 3

1. Write the following small numbers in scientific notation :-

    (a) $0 \cdot 003$ (b) $0 \cdot 000 074$ (c) $0 \cdot 0286$ (d) $0 \cdot 000 006$

    (e) $0 \cdot 000 482$ (f) $0 \cdot 287$ (g) $0 \cdot 003 93$ (h) $0 \cdot 000 07$.

2. Write the following numbers in full :-

    (a) $5 \cdot 1 \times 10^{-2}$ (b) $3 \cdot 6 \times 10^{-4}$ (c) $2 \cdot 74 \times 10^{-3}$ (d) $5 \cdot 06 \times 10^{-5}$

    (e) $3 \cdot 2741 \times 10^{-1}$ (f) 4×10^{-3} (g) 7×10^{-5} (h) $8 \cdot 009 \times 10^{-6}$.

3. A box of toffees weighs $5 \cdot 81 \times 10^{-2}$ kilograms.

    Is this more or less than 58 grams ?

4. A molecule of water weighs 2.88×10^{-26} kg. Write this out in full.
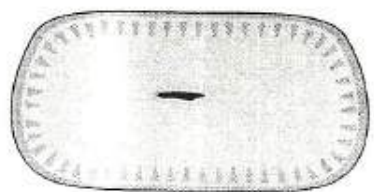
Exercise 1

1. Find the following (remember - no calculator) :-

    (a) 10% of £34

    (b) 70% of £20

    (c) 20% of £6·50

    (d) 80% of 20p

    (e) 25% of £4200

    (f) $33\frac{1}{3}$% of £18

    (g) 5% of £7·20

    (h) 1% of £9

    (i) 2·5% of £6.

2. Write each of the following as a fraction AND as a decimal :-

    (a) 36%   (b) 45%   (c) 8%   (d) 11%   (e) 12·5%.

3. Write these percentages as fractions and simplify :-

    (a) 15%   (b) 30%   (c) 4%   (d) 96%   (e) 22%.

Exercise 2

1. Express £20 as a percentage of :-

    (a) £80

    (b) £50

    (c) £1000

    (d) £4000.

2. Express :-

    (a) £39 as a percentage of £78

    (b) £40 as a percentage of £120

    (c) £2·60 as a percentage of £40

    (d) 90p as a percentage of £7·20.

3. From a monthly wage of £1450, I pay £94·25 in council tax.

    What percentage of my wage goes on council tax ?

4. The local paper girl got paid £15·25 per week last year.
    This year her pay has risen to £17·99.

    What percentage pay rise did she receive ? (to 1 decimal place)

5. "Greenland", the frozen food outlet chain, buy "Granny's mince pies" in boxes of 20 for a total cost of £30.

    The mince pies are then sold to shops for £1·80 each.

    Calculate the percentage profit made by "Greenland", when they sell a full box of Granny's pies.

Exercise 3

1. After a 20% pay rise Donald's wage for his part-time job rose to £72.

   Calculate Donald's wage before his pay rise.

2. A jumper's price is reduced by 15%. It was on sale for £68.

   What was the original price of the jumper ?

3. McGyll's Bus Company increased all of its ticket prices by 4%.

   What was the original cost for a bus ticket which now costs £1·30 ?

4. A detached villa has appreciated in value by 14·5%.

   It is now valued at £148 850.

   Calculate the original value of the villa.

5. A lawn mower's price was reduced by 25% in a sale. I bought one in the sale for £90.

   What was the cost of a lawn mower before the sale ?

Exercise 4

1. Fares on the Subway Trains are expected to rise soon by 8%.

   What will be the new cost of a ticket which just now is priced £1·25 ?

2. In a sale, a polo shirt, normally priced at £25·50, is reduced by 30%.

   What is the sale price of the shirt ?

3. (a) Increase £70 by 3%.   (b) Decrease £620 by 4·5%.

   (c) Increase £1220 by 17·5%.   (d) Decrease £80 000 by 7·25%.

4. A petrol lawn mower bought for £180 in 2001 has depreciated in value over the past few years.
   It is now worth 84% less than its original value.

   What is the mower worth today ?

5. Mildred borrows £2500 from a Finance Company.

   They add on interest of 12% in the first month, 20% in 2nd month and 25% in the third month.

   Including the amount she borrowed, how much will Mildred owe after 3 months ?

Exercise 5E

1. Calculate the amount of money in each bank account after the given length of time:-

    (a) £500 after 3 years in an account paying 5% p/a

    (b) £12000 after 4 years in an account paying 3% p/a

    (c) £7500 after 5 years in an account paying 1.5% p/a

    (d) £2250 after 3 years in an account paying 2.25% p/a.

MNU 4-07b: I can solve problems involving fractions and mixed numbers in context, using addition, subtraction or multiplication.

Exercise 1

1. Copy each of the following and simplify (where possible) :-

    (a) $\frac{1}{5}+\frac{3}{5}$
    (b) $\frac{2}{7}+\frac{1}{7}$
    (c) $\frac{5}{8}-\frac{2}{8}$
    (d) $\frac{8}{11}-\frac{5}{11}$

    (e) $\frac{4}{5}-\frac{3}{5}$
    (f) $\frac{7}{8}-\frac{5}{8}$
    (g) $\frac{1}{8}+\frac{3}{8}$
    (h) $\frac{4}{10}+\frac{6}{10}$

2. Copy each and simplify :-

    (a) $4\frac{1}{2}+2\frac{1}{2}$
    (b) $6\frac{1}{4}+1\frac{1}{4}$
    (c) $4\frac{3}{4}+2\frac{3}{4}$
    (d) $5\frac{7}{8}+\frac{5}{8}$

    (e) $2\frac{3}{4}-2\frac{1}{4}$
    (f) $7\frac{5}{8}-4\frac{3}{8}$
    (g) $10\frac{7}{10}-5\frac{3}{10}$
    (h) $2\frac{13}{15}-1\frac{8}{15}$

3. Jerry mixed $2\frac{3}{4}$ kg's of currants and $1\frac{1}{4}$ kg's of raisins into a bowl.

    What is the total weight of currants and raisins ?

4. Bill jogged $5\frac{3}{4}$ km of an eight kilometre run.

    How far has Bill still to jog ?

Exercise 2

1. Copy and complete each of the following calculations and simplify where possible :-

    (a) $\frac{1}{2}+\frac{1}{8}$
    (b) $\frac{2}{3}+\frac{1}{6}$
    (c) $\frac{3}{4}-\frac{5}{12}$
    (d) $\frac{5}{16}-\frac{1}{4}$

    (e) $\frac{7}{10}+\frac{3}{5}$
    (f) $\frac{5}{6}-\frac{7}{12}$
    (g) $\frac{9}{16}+\frac{3}{4}$
    (h) $\frac{9}{51}-\frac{3}{17}$

    (i) $\frac{2}{3}+\frac{1}{2}+\frac{1}{4}$
    (j) $\frac{5}{12}+\frac{1}{4}-\frac{1}{2}$
    (k) $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}$

2. Copy and simplify :-

    (a) $3\frac{1}{2}+1\frac{1}{3}$
    (b) $1\frac{1}{3}+3\frac{1}{4}$
    (c) $4\frac{1}{2}+1\frac{2}{5}$
    (d) $4\frac{1}{2}-1\frac{2}{5}$

    (e) $6\frac{7}{8}-4\frac{3}{4}$
    (f) $1\frac{3}{5}-\frac{7}{15}$
    (g) $4\frac{9}{10}-3\frac{3}{4}$
    (h) $4\frac{9}{10}+3\frac{3}{4}$

Exercise 3

1. Copy and complete each calculation (simplifying where possible) :-

(a) $\frac{2}{3} \times \frac{5}{7}$ (b) $\frac{1}{2} \times \frac{3}{5}$ (c) $\frac{3}{4} \times \frac{7}{8}$ (d) $\frac{5}{8} \times \frac{2}{3}$

(e) $\frac{7}{8} \times \frac{1}{14}$ (f) $\frac{2}{3} \times \frac{15}{16}$ (g) $\frac{7}{10} \times \frac{5}{14}$ (h) $\frac{5}{4} \times \frac{8}{15}$

2. Simplify :-

(a) $2\frac{1}{4} \times 3\frac{1}{2}$ (b) $4\frac{2}{3} \times 3\frac{1}{2}$ (c) $2\frac{3}{4} \times 3\frac{1}{2}$ (d) $1\frac{2}{5} \times 2\frac{3}{5}$

(e) $5\frac{4}{5} \times 1\frac{2}{3}$ (f) $1\frac{1}{7} \times 2\frac{4}{5}$ (g) $1\frac{4}{9} \times 4\frac{1}{2}$ (h) $5\frac{3}{5} \times \frac{6}{7}$

3. A triangle has dimensions as shown.

   Calculate the area of the triangle.

$2\frac{2}{3}$ m $4\frac{1}{4}$ m
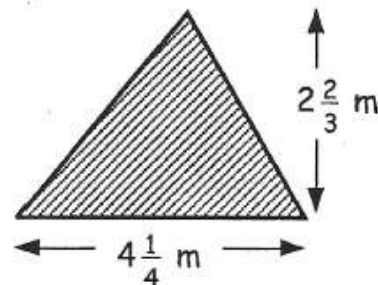
Exercise 4

1. Copy and complete each calculation (simplifying where possible) :-

(a) $\frac{3}{5} \div \frac{3}{4}$ (b) $\frac{4}{5} \div \frac{2}{15}$ (c) $\frac{1}{8} \div \frac{1}{4}$ (d) $\frac{4}{9} \div \frac{4}{15}$

(e) $\frac{7}{11} \div \frac{7}{22}$ (f) $\frac{8}{15} \div \frac{2}{3}$ (g) $\frac{11}{36} \div \frac{22}{24}$ (h) $\frac{10}{33} \div \frac{25}{36}$

2. Copy and complete :-

(a) $6\frac{2}{3} \div 2\frac{1}{2}$ (b) $4\frac{1}{5} \div 3\frac{1}{2}$ (c) $1\frac{5}{7} \div 1\frac{1}{5}$ (d) $1\frac{2}{3} \div 2\frac{2}{9}$

(e) $4\frac{4}{5} \div 1\frac{1}{15}$ (f) $1\frac{1}{2} \div 1\frac{3}{7}$ (g) $5\frac{2}{5} \div 6\frac{2}{5}$ (h) $2\frac{5}{8} \div 1\frac{2}{5}$

3. A twenty metre length of rope is cut into $1\frac{5}{8}$ metre pieces.

   How much of the rope would be left over ?

MNU 4-08a: Using proportion, I can calculate the change in one quantity caused by a change in a related quantity and solve real-life problems.

Exercise 1

1. Copy each ratio and simplify as far as possible :-

(a) $5 : 10$ (b) $12 : 36$ (c) $4 : 20$ (d) $5 : 35$

(e) $27 : 3$ (f) $36 : 16$ (g) $100 : 8$ (h) $240 : 30$

(i) $25 : 625$ (j) $12 : 16 : 24$ (k) $8 : 40 : 72$ (l) $6 : 81 : 333$

2. Simplify each of the following to unitary ratios :-

(a) $\frac{1}{2} : 6$ (b) $\frac{1}{3} : 9$ (c) $12 : 0\cdot2$ (d) $\frac{1}{17} : 10$

3. Change each quantity to similar units and simplify :-

(a) $\frac{1}{2}$ kg : 200 g　(b) $\frac{1}{3}$ hour : 10 mins　(c) 50 mm : $\frac{1}{5}$ cm　(d) $\frac{1}{8}$ litre : 250 ml

4. Farmer Ellis uses the table of ratios to feed his chickens using chicken feed and corn.

Mix in the ratio		
Strength	Feed	: Corn
Weak	10 :	1
Light	7 :	1
Medium	7 .	2
Strong	5 :	3
Very Strong	4 :	5

Which feed strength will he get if he mixes :-

(a) 70g of feed and 10g of corn ?

(b) 210g of feed and 60g of corn ?

(c) 1 kg of feed and 1250g of corn ?

(d) 600g of corn and 1 kg of feed ?

Exercise 2

1. On a small aircraft, the ratio of men to women is 2 : 3.

   If there are 8 men on the aircraft, how many women are there ?

2. The ratio of girls to boys in $3C_2$ is 4 : 5.

   (a) If there are 12 girls, how many boys are there ?

   (b) If there are 20 boys, how many girls are there ?

3. Show all your working for each of the following :-

   (a) Share £1500 between Bill and Ben in the ratio 3 : 2.

   (b) Share 360 sweets between May and Matt in the ratio 5 : 7.

   (c) Share 1250 €'s between Tom and Tim in the ratio 7 : 3.

   (d) Share ten thousand pounds between Dan and Fran in the ratio 23 : 27.

Exercise 3

1.

   The cost of ten calculators is £50.
   How much would it cost for :-

   (a) one calculator　(b) nine calculators ?

2. A photocopy machine can produce 300 copies in 2 minutes.

   How many copies will the machine make in :-

   (a) 3 minutes　　(b) 11 minutes

   (c) 30 seconds　　(d) 20 seconds ?
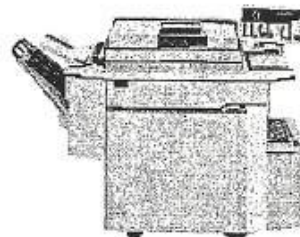
3. Water poured into an empty barrel at a steady rate.
   In 10 minutes the water level had risen by 3 centimetres.
   How long should the barrel take to fill if it is 120 centimetres tall ?

Exercise 4

1. State which graph shows two quantities which are in direct proportion. Explain.
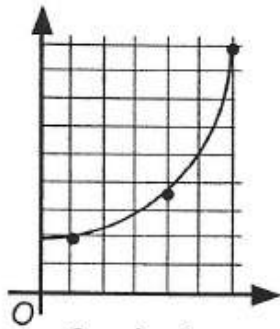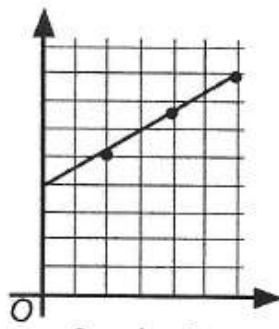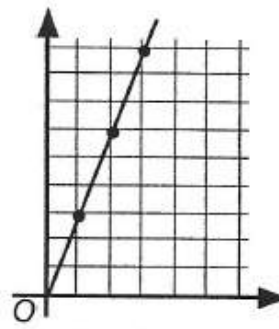
Graph 1   Graph 2   Graph 3   Graph 4
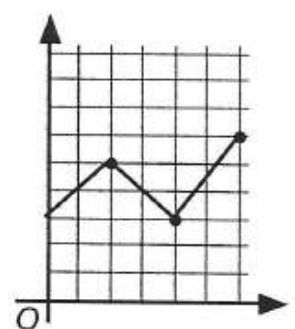
2. Which of the following tables indicate direct proportion ?

(a)

x	1	2	3	4
y	7	14	21	28

(b)

x	1	2	3	4
y	6	11	17	24

(c)

x	2	4	6	8
y	3	6	9	12

(d)

x	2	4	6	8
y	13	17	21	25

Exercise 5

1. If it took two men 6 hours to build a wall, how long would it have taken 3 men ?
   (Remember : more men - less time)

2. If it took 7 park wardens 6 hours to clear away litter, how long would it have taken 3 wardens ?

3. Six men take 6 hours to build a kit car. How long will it take eight men ?

4. Nine scouts have eight days rations. How many days rations would there then be if **three more** scouts join them ?

5. Oliver and his 5 friends take an hour to wrap all the presents for the church tombola. How long would it have taken if 4 **more** friends had helped with the wrapping ?

6. Five bees take eight days to make 5 millilitres of honey. How many bees would it take to make the same amount in ten days ?

7. At 30 miles per hour, it takes me 24 minutes to drive to my work.

   How long should it take if I were to average 40 miles per hour ?

Exercise 1

1. Travis works in a sports shop and gets a basic pay of £4·50 per hour.

   If he worked 35 hours last week, how much was he paid ?
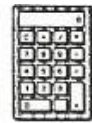
2. Simone works as a radiographer.
   Her hourly rate of pay is £14·50.

   She worked for 30 hours last week.
   How much did she earn ?

3. Jane works for an Insurance Company and her friend Pete is a mechanic.
   Jane earns £8·70 per hour whereas Pete is paid £7·90 per hour.
   Last week, Jane worked 30 hours and Pete 34 hours.

   (a) Calculate Jane's pay and Pete's pay for the week.

   (b) How much LESS did Jane earn than Pete ?

4. Fraser's payslip last week showed he earned £322.
   He knew he had worked for 35 hours.

   Calculate Fraser's hourly rate.

5. Danny works as a cook in a bistro.

   He earned £545·60 last week for his 44 hours.

   (a) Calculate his hourly rate of pay.

   (b) This week he only worked for 30 hours.
   How much pay is he due this week ?

Exercise 2

1. Polly's monthly pay at The Art Shop is £584.

   Calculate her annual (yearly) pay .
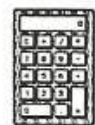
2. Danny has a part-time job as a milk boy. He is paid £38·50 per week.
   Calculate Danny's pay for a year.

3. Debbie and her sister Ashley are both dress designers.
   Debbie is paid monthly and earns £1280·50 per month.
   Ashley is paid weekly and gets £295·25 per week.

   (a) Calculate Debbie's annual pay.

   (b) Calculate Ashley 's annual pay.

   (c) Who's annual pay is greater, and by how much ?

4. Bob earns £25 800 per year as a train driver.

   Calculate his monthly salary.

5. Hazel works as a shop assistant for More Stores.
   She is paid £8 216 per year.

   Calculate Hazel's **weekly** wage.

6. Faisal is offered a job as an assistant baker. His salary is £8 892 per year.
   He can choose to be paid weekly or monthly.

   (a) How much would his monthly salary be ?

   (b) Now calculate how much he would earn weekly
       if this was his chosen method of payment.

Exercise 3

1. Here is Bobby Wright's payslip for a week.

Employee No. 432	Name B. Wright	Tax Code 416L	Week 09
Basic Pay £210	Overtime £25	Commission –	Gross Pay
Income Tax £51	Pension –	Nat Ins £23·40	Total Deductions
			Net Pay

Bobby

Calculate Bobby's :-

(a) Gross Pay   (b) Total Deductions   (c) Net Pay.

2. John Packhard is a computer salesman.

   Here is his monthly salary slip :-

Employee No. 086	Name J. Packhard		Tax Code 621L	Month 03
Basic Pay £1000	Overtime –	Commission –	Bonus ?	Gross Pay ?
Income Tax £250	Pension ?	Nat Ins £120	Other Deductions —	Total Deductions £400
				Net Pay £1500

John

Use the information in the payslip to calculate John's :-

(a) Gross Pay. [use his net pay and total deductions]

(b) Pension contribution.

(c) Bonus.

Exercise 1

1. Find the unknown quantity in each of the following :-

   (a) Distance = ? km.   Speed = 20 km/hr.   Time : $3\frac{1}{2}$ hours.

   (b) Distance = 90 miles.   Speed = ? m.p.h.   Time : $1\frac{1}{2}$ hours.

   (c) Distance = 100 km.   Speed = 40 km/hr.   Time : ? hours.

2. (a) A tortoise walks at 2 metres per minute.

      How long will it take to walk 9 metres ?

   (b) Addison can sprint at 4 metres per second.

      How far will he travel in ten and a half seconds ?

   (c) A bus journey, 60 kilometres long, takes one and a half hours.

      How fast is the bus travelling ?
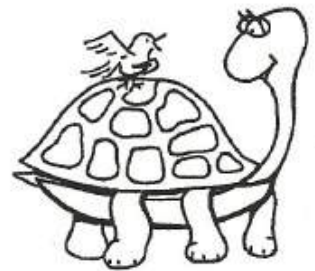
3. A jet has a 400 mile journey to complete.

   How long would it take at a speed of :-

   (a) 200 m.p.h.   (b) 800 m.p.h.   (c) 600 m.p.h. ?

4. Jane ran round a 1500 metre track and took 6 minutes.

   (a)   At what speed in metres per minute was Jane running ?

   (b)   Bob beat Jane's time by a minute.

         What was Bob's speed ?

5. A rocket ship is 4200 km from Earth.

   The rocket then travels away from Earth at its maximum speed of 2400 km/hr for $4\frac{1}{2}$ hours.

   (a) How far away from Earth is the spaceship now ?

   (b) How quickly can the spaceship then return to Earth, travelling at its maximum speed ?

6. Ryan cycled from home to school (8 km) at a speed of 16 km/hr. He had to walk home from school due to a puncture.

   If Ryan walked at a speed of 6 km/hr, how much quicker was he cycling than walking ?

Exercise 2

1. Change the following to decimals of an hour :-

   (a) 45 minutes   (b) 24 minutes   (c) 36 minutes   (d) 27 minutes.

2. Change the following to decimals of a hour giving your answer to two decimal places :-

   (a) 7 minutes   (b) 40 minutes   (c) 8 minutes   (d) 124 minutes.

3. Change each time to decimal form :-

   (a) 2 hrs 33 mins   (b) 1 hr 48 mins   (c) 5 hrs 6 mins   (d) 3 hrs 3 mins.

4. Change the calculator displays (shown in hours) to hours and minutes :-

   (a) 2·8   On/Off

   (b) 4·4   On/Off

   (c) 0·35   On/Off

5. Change each of the following to hours and minutes :-

   (a) 4·6 hours   (b) 8·15 hours   (c) 3·05 hours   (d) 1·125 hours.

6. Calculate the unknown quantity in each of the following :-

   (a) Distance = ? km   Speed = 80 km/hr   Time : 2 hrs 45 mins.

   (b) Distance = 70 miles   Speed = ? m.p.h.   Time : 1 hr 24 mins.

   (c) Distance = 420 km   Speed = 50 km/hr   Time : ? hrs ? mins.

Exercise 3

1. The distance-time graph shows the journey Maggie made from her house to her favourite clothes shop and home again.

   (a) How long did the drive to the shop take ?

   (b) How far away is the shop from her house ?

   (c) How long did she stay at the shop ?

   (d) Calculate Maggie's speed :-

       (i) going to the shop.

       (ii) on the journey home.
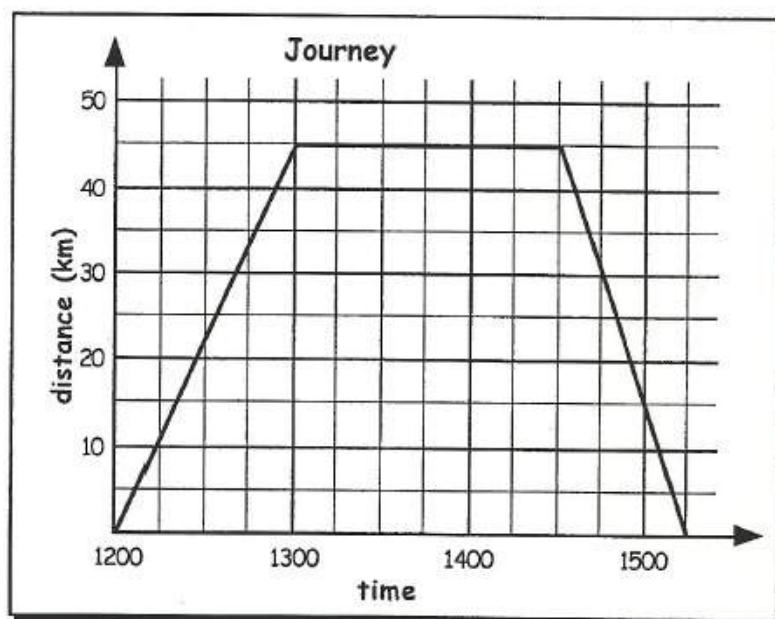
3. Billy set off at 11·00 am on Sunday and drove 50 miles to Edinburgh at an average speed of 40 mph. He shopped for 45 minutes in Edinburgh, then drove home at an average speed of 50 mph.

Show Billy's journey on a Distance - Time graph.
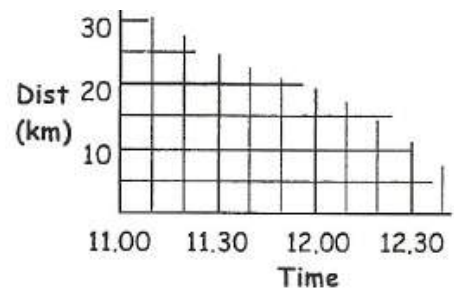
Exercise 1

1. For the triangular prism shown, calculate :-

    (a) (i) the area of the rectangle A.

        (ii) the areas of rectangles B.

    (b) the areas of triangles C.

    (c) the total surface area.
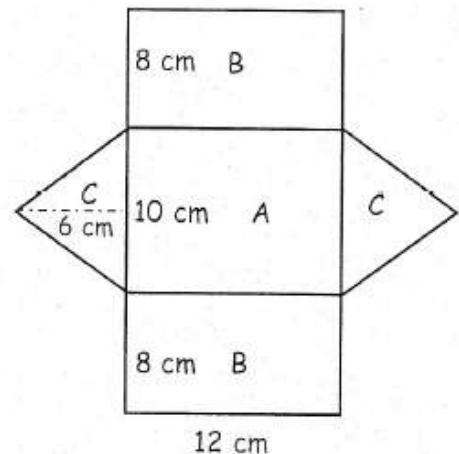
2. Calculate :-

    (a) (i) the area of the rectangular floor.

        (ii) the area of the rectangular "back".

        (iii) the area of the rectangular "sloping side".

    (b) the area of the 2 right angled triangles.

    (c) the total surface area.
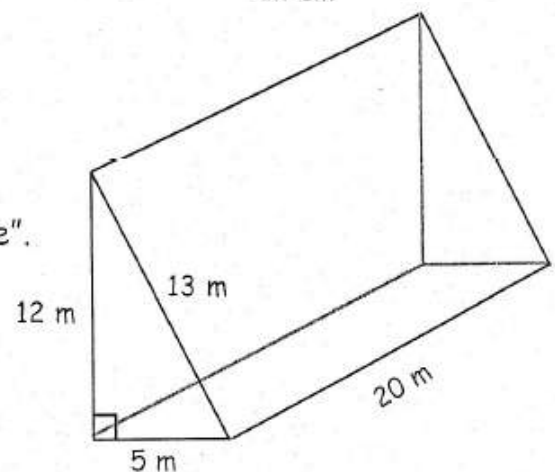
3. A wedding reception was held in a large marquee as shown.
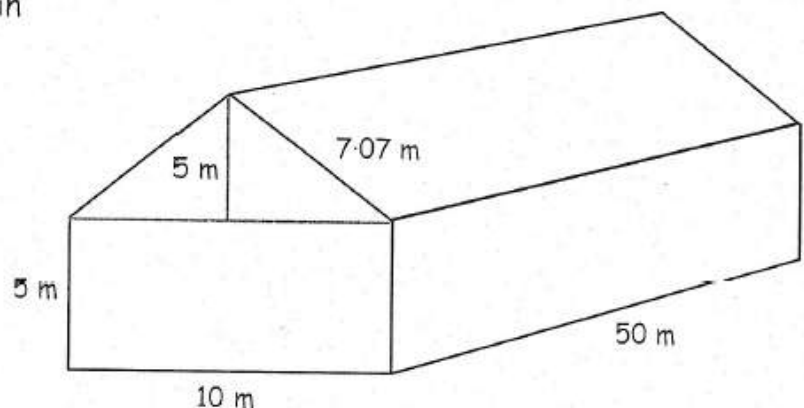
    (a) Calculate the area of each end of the marquee.

    (b) Calculate the total surface area of the marquee including the canvas floor.

Page 18

4. (a) Calculate the circumference of this circular top. (C = πD or C = 2πr)

    (b) Calculate the <u>curved surface area</u> of this cylinder.
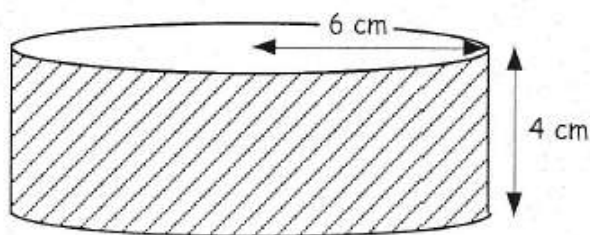
5. For each cylinder find :-

    (i)   the area of the circular ends. (A = πr^2 twice !)

    (ii) the curved surface area.

    (iii) the total surface area.

    (a)   (b)
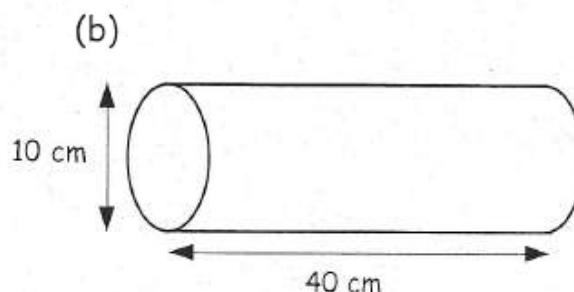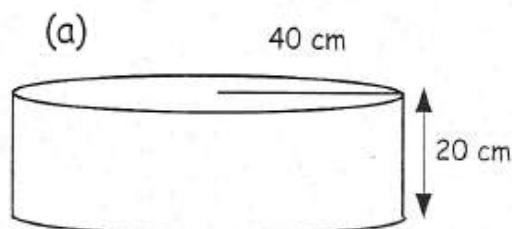
6. Shown is a box of flowering seeds covered by a curved piece of clear plastic.
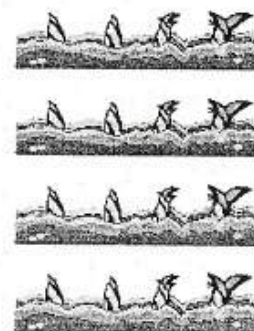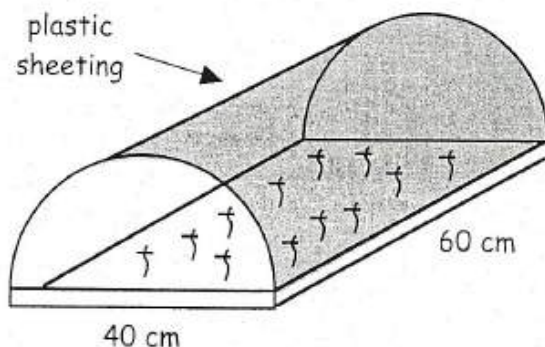
    Calculate the area of curved clear plastic needed to cover the seed box.

MNU 4-11c: I have explored with others the practicalities of the use of 3D objects in everyday life and can solve problems involving the volume of a prism, using a formula to make related calculations when required.

Exercise 1

1. Calculate the volumes of each of the cuboids (show all your working) :-

    (a)   (b)   (c)

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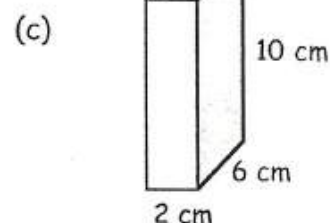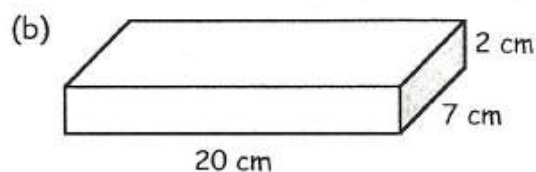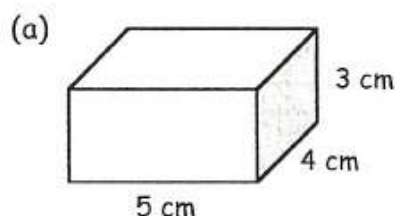
2. Calculate the volume of the following triangular prisms.

(a)
Area = 20 cm²

2 cm

(b)
2 cm

4 cm

5 cm
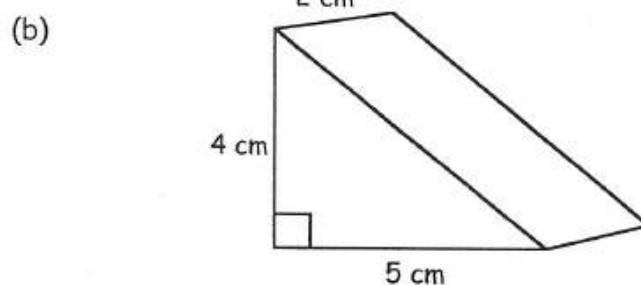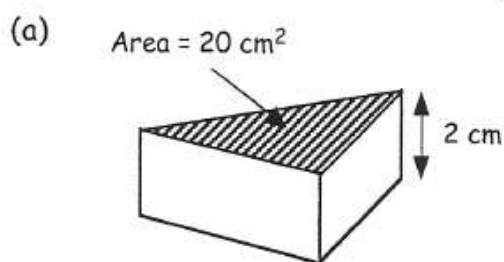
3. Find the volume of each of the following cylinders :-
(the areas of the circular bases are given)

(a)
A = 95 cm²

1·2 cm

(b)
6 cm

A = 45 cm²
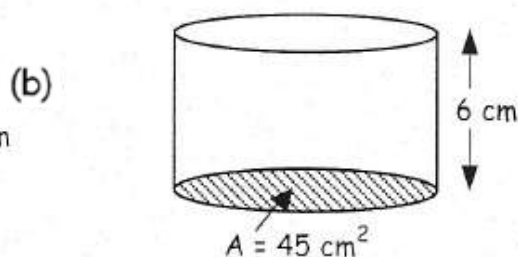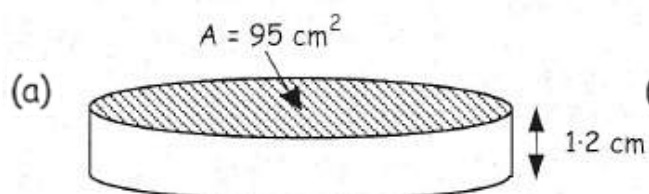
4. Use the formula V = πr²h to find the volumes of the following cylinders,
giving you answers to 2 decimal places :-
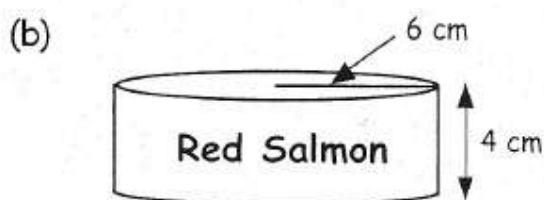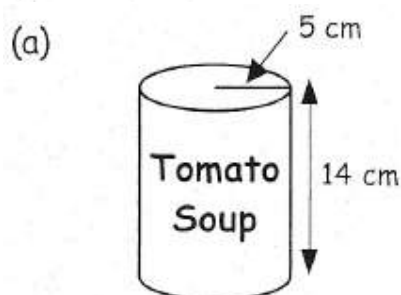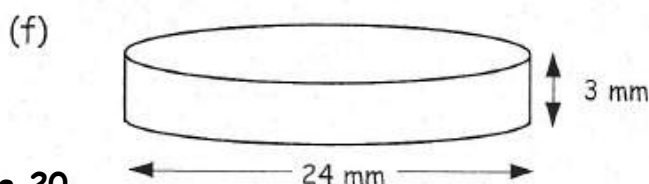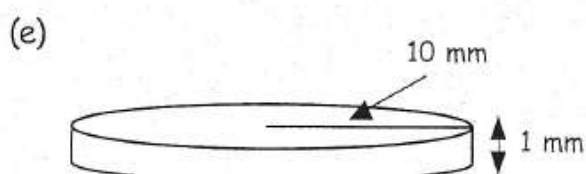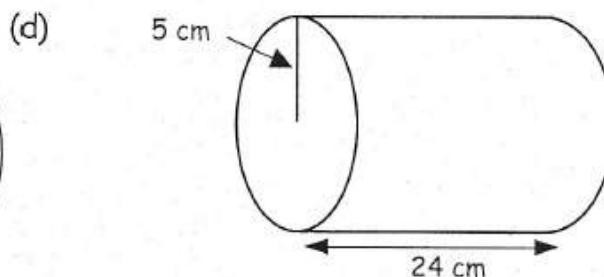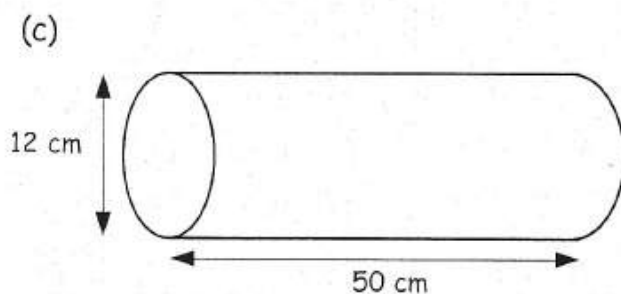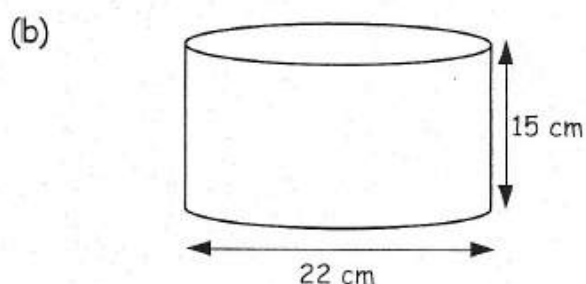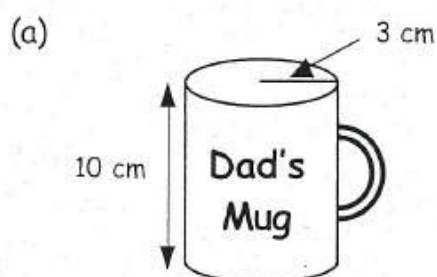
(a)
5 cm

Tomato Soup   14 cm

(b)
6 cm

Red Salmon   4 cm

5. Calculate the volumes of the following cylinders :-

(a)
3 cm

10 cm   Dad's Mug

(b)
15 cm

22 cm

(c)
12 cm

50 cm

(d)
5 cm

24 cm

(e)
10 mm

1 mm

(f)
3 mm

24 mm

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Exercise 1

1. A restaurant has triangular tables. Each table seats 3 customers.
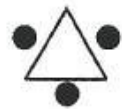
1 table
3 customers
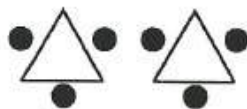
2 tables
6 customers

3 tables
9 customers

(a) Copy and complete the table :-

No. of Tables (T)	1	2	3	4	5	6
No. of Customers (C)	3	6	9	?	?	?

3   3   3

(b) For every extra table, how many extra customers are there ?

(c) Copy and complete : -   " number of Customers = ... × number of Tables ".

(d) Write down a formula using symbols to show this. (C = ... × .....).

2. A school dining room is laid out as shown.
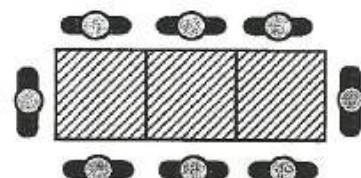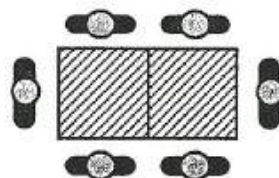
(a)   Draw neatly the next table pattern with 4 square tables.

(b)   Copy and complete the following table : -

No. of tables (T)	1	2	3	4	5	6
No. of pupils (P)	4	6	8	?	?	?

2   2   ?

(c)   For every extra table, how many extra pupils can be seated ?

(d)   Write down the formula using **symbols** for calculating the number of pupils that can be seated if you know the number of tables :-

copy :- $P = ? \times T + ?$ ←——— remember the correction number

(e) Use your formula to decide how many pupils can be seated with 12 tables.

(f) How many pupils can be seated with 50 tables ?

3. A boy uses building blocks to make these patterns.

Pattern No. 1
Blocks – 2
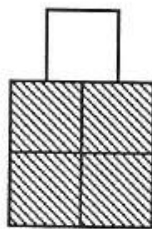
Pattern No. 2
Blocks – 5
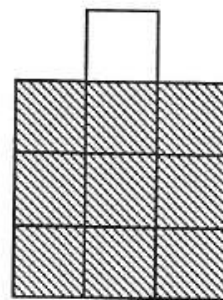
Pattern No. 3
Blocks – 10

(a) Draw the above 3 patterns and add pattern numbers 4 and 5.

(b) Copy and complete this table.

Pattern No. (N)	1	2	3	4	5	6	7	8	9
Blocks (B)	2	5	10	?	?	?	?	?	?

(c) Write down a formula linking the pattern number (N) with the number of Blocks (B).

4. Look at this pattern of square garden slabs surrounding a square lawn.

pattern 1

8 slabs

pattern 2
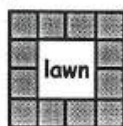
12 slabs

pattern 3
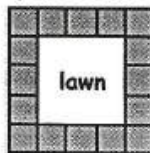
? slabs

pattern 4
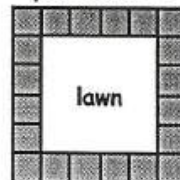
? slabs

(a) How many slabs are needed for patterns number 3 and 4 ?

(b) Draw pattern 5 and say how many slabs are needed.

(c) Can you see that   Pattern 1 => $3^2 - 1^2 = 9 - 1 = 8$?

Pattern 2 => $4^2 - 2^2 = 16 - 4 = 12$?

Express each of the next 3 patterns in the same way.

(d) Use this to find how many slabs are needed for :-

(i) pattern 10   (ii) Pattern 20.

Exercise 1

1. Write down the <u>gradients</u> of each of these lines :-   (simplify your fractions)

    (a)   (b)   (c)
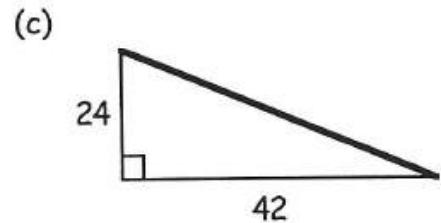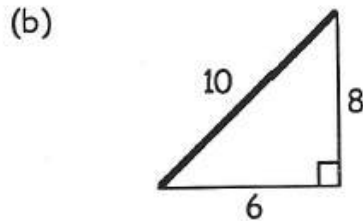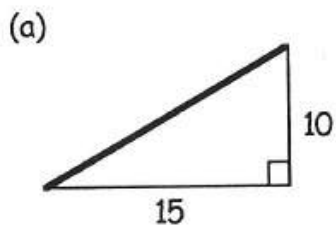
2. The gradient of this line is given by

    gradient = $\frac{7}{12}$ = 7 ÷ 12 = 0·5833....
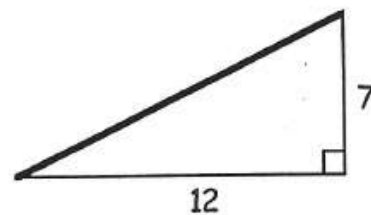
    (a) Find the gradients of these three lines :-
        (Give them as decimals correct to 3 decimal places)

    (i)   (ii)   (iii)
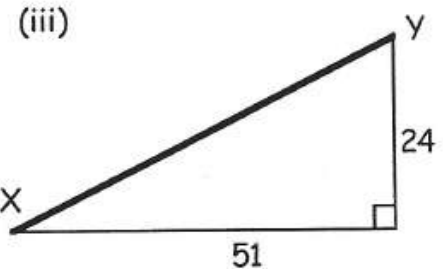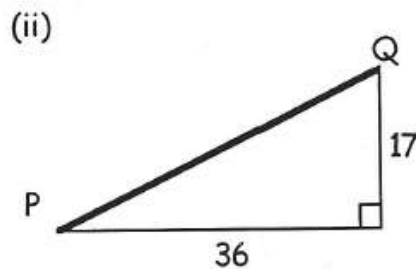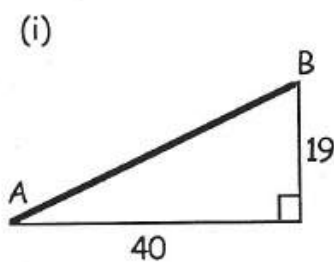
Exercise 2

The gradient of the line AB can be represented by the letter m.

$$m_{AB} = \frac{y\text{-difference}}{x\text{-difference}} = \frac{\text{vertical}}{\text{horizontal}}$$
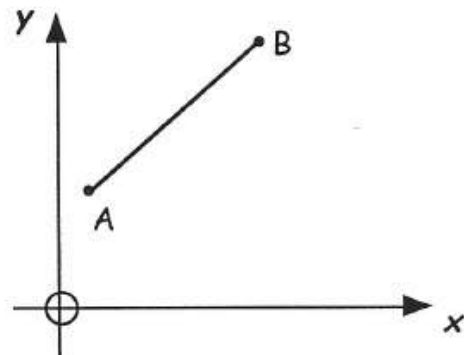
1. Use the formula to calculate the gradients of these lines.
    (<u>Remember</u> – lines sloping "*downwards*" have a negative gradient).

    (a)   (b)   (c)
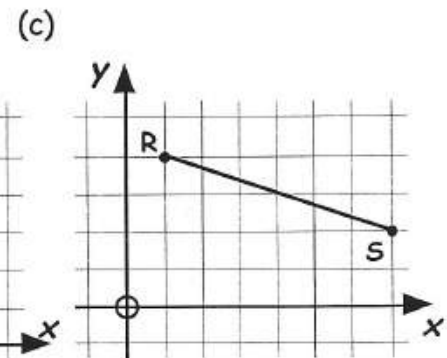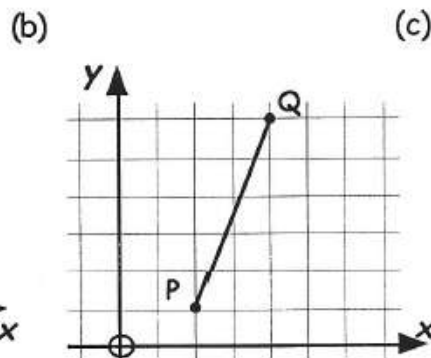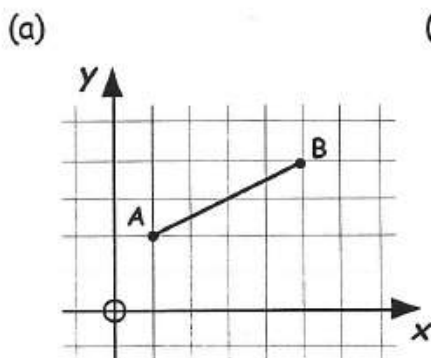
2. Calculate the gradient of each of the lines shown. [remember the negative sign where required].
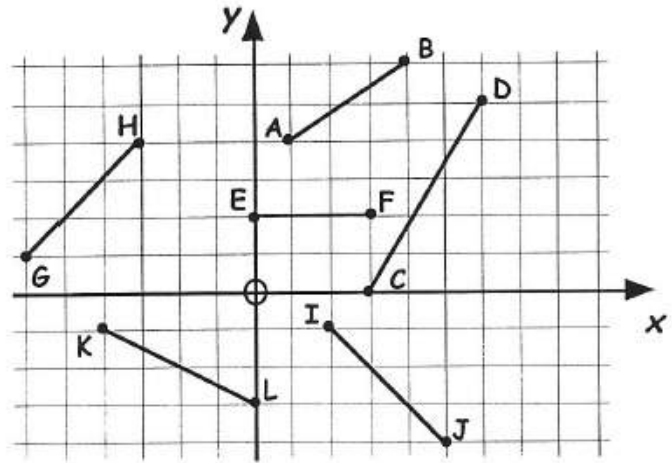
3. Plot the 4 points A(1,3), B(4,4), P(2,0), Q(8,2) on a coordinate diagram. Join A to B and P to Q.

   (a) Calculate the gradient of line AB. (leave as a fraction)

   (b) Calculate the gradient of line PQ. (simplify your fraction)

   (c) What can you now say about the 2 lines AB and PQ ?

4. Find the gradient of each of these ladders:

(a)

Ladder A

7·5 m

5 m

(b)

Ladder B

7 m

2 m

(c)

Ladder C

7 m

3 m
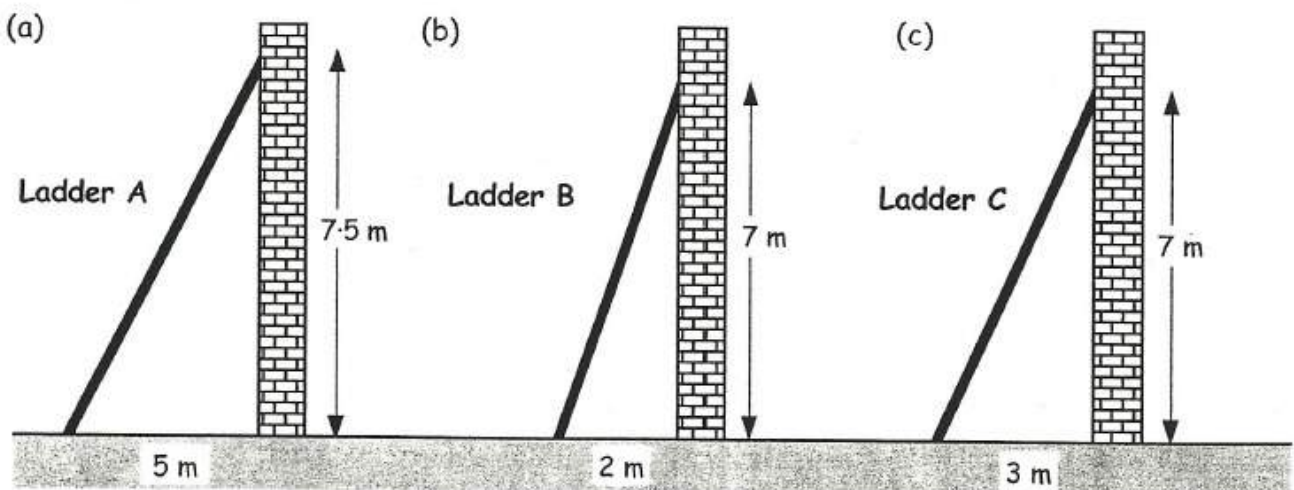
5. A ladder is "SAFE" if it has a gradient with a value between 3 and 4.

   Which of the above three ladders is safe and which is unsafe ?

MNU 4-13c: Having investigated the pattern of the coordinate points lying on a horizontal or vertical line, I can describe the pattern using a simple equation.

Exercise 1

1. State the gradient of: (a) any **horizontal** line

   (b) any **vertical** line

2. M is the point (4, -3).

    (a) Write down the coordinates of any point P so that the line MP is **vertical**.

    (b) Write down the coordinates of any point Q so that the line MQ is **horizontal**.

3. (a) On a coordinate diagram, draw the lines x = 1, x = 10, y = -2 and y = 5.

    (b) Write down the coordinates of the corners of the rectangle on your diagram.

4. A kite is formed by joining the points A (-2, 3), B (1, 8), C (10, 3) and D (1, -2).

    (a) Write down the equation of: (i) diagonal AC

                                    (ii) diagonal BD

    (b) Write down the equation of the vertical line passing through point A

    (c) **TRICKY!** Without drawing the kite, write down the coordinates of the point where the two diagonals cross over.

> **MNU 4-13d:** **I can use a given formula to generate points lying on a straight line, plot them to create a graphical representation then use this to answer related questions.**

Exercise 1

1. (a) Look at the table for the line $y = 2x$.

x	0	1	2	3	4
$y = 2x$	0	2	4	...	...

    (b) Copy and complete the list of coordinates: (0, 0), (1, 2), (2, 4), (......), (........).

    (c) Draw a coordinate diagram, plot the 5 points and complete the line.

2. Make a table, list and plot the coordinates on a diagram and draw the line

    (a) $y = 4x$.

    (b) $y = \frac{1}{2}x$.

Exercise 2

1. Draw the line $y = 2x + 1$ as follows:

    (a) Copy and complete this table:

x	0	1	2	3	4
$y = 2x + 1$	2×0+1	2×1+1	2×2+1	.....	......

    (b) Copy and complete the list of coordinates:

        (0, 1), (1, 3), (2, 5), (3,....), (..., ...).

    (c) Copy the coordinate diagram, plot the points and draw the line. Label the line $y = 2x + 1$ on your diagram.
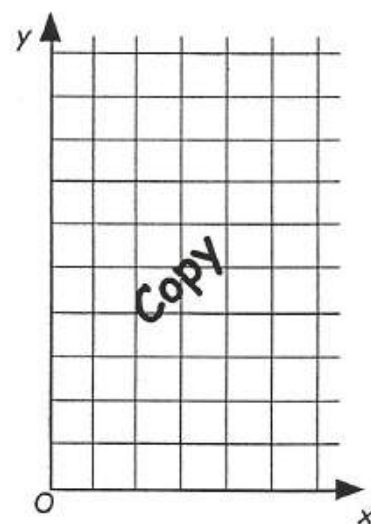
2. Draw the line $y = \frac{1}{2}x + 1$ by repeating the process from question 1.

x	0	2	4	6	8
$y = \frac{1}{2}x + 1$	$\frac{1}{2}$ of 0 + 1	$\frac{1}{2}$ of 2 + 1	$\frac{1}{2}$ of 4 + 1	....	......

3. Draw the lines: (a) $y = 2x + 2$ (b) $y = 3x - 2$ (c) $y = \frac{1}{3}x - 1$

Exercise 3

1. For each of the following lines :-

   (i) Calculate the gradient of the line.
   (ii) Write down the equation of the line in the form $y = ... x$

(a)   (b)   (c)
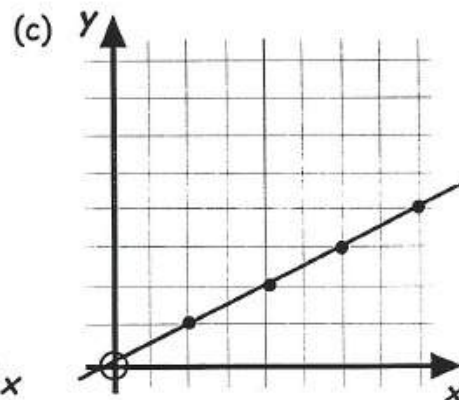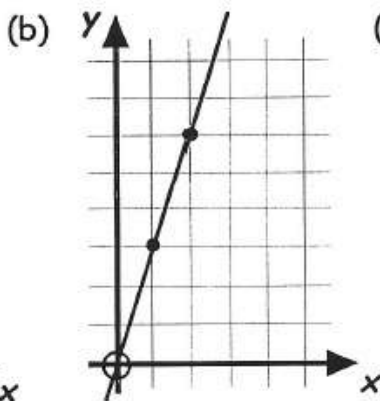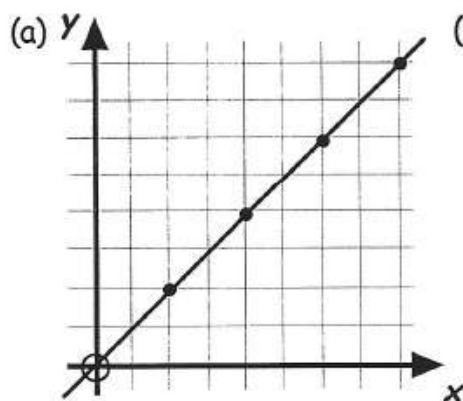
The gradient of this line is $\frac{3}{4}$.

Its equation is $P = \frac{3}{4}t$ (not $y = \frac{3}{4}x$).
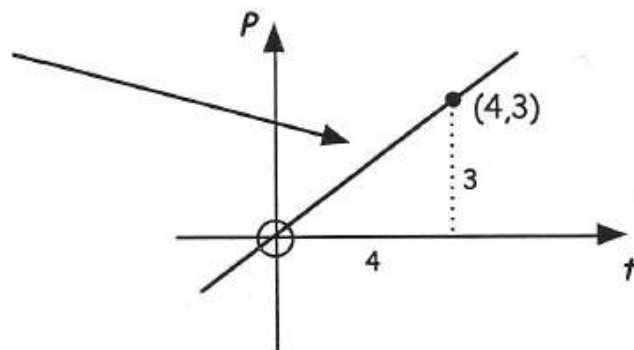
2. For each of these,

   (i) Calculate the gradient of the line.
   (ii) Write down the equation of each.

(a)   (b)   (c)

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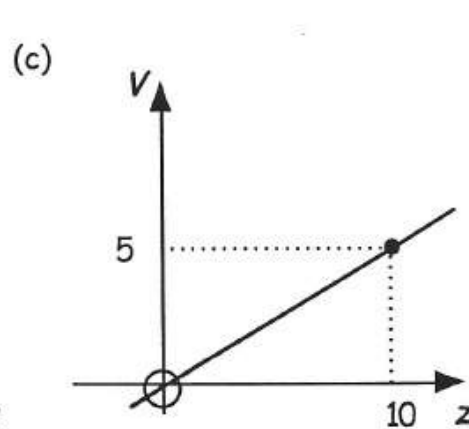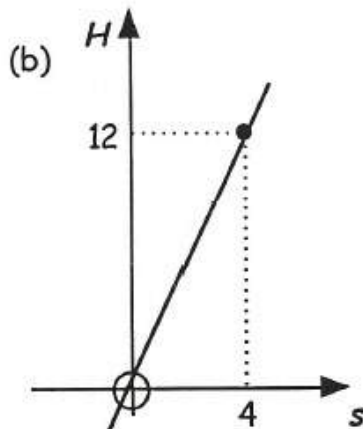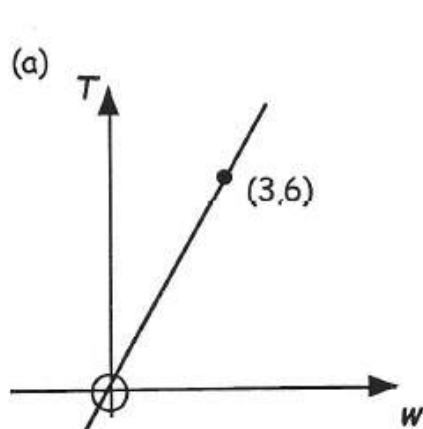
Exercise 4

1. (a) Write down the coordinates of the point where this line cuts the y-axis.

   (b) Calculate the gradient of the line.

   (c) Now write down its equation in the form $\boxed{y = \dots x + \dots}$

(3,9)
(0,3)
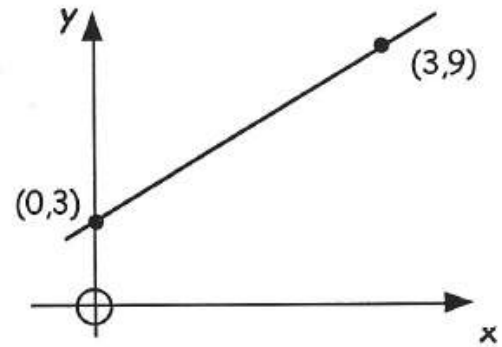
2. Write down the equations of these lines :–

   (Find the gradients and the points where they cut the y-axis)

   (a)

(2,9)
(0,1)

   (b)

(0,5)
(4,7)

   (c)

(3,4)
(0,-2)

3. Write down the equations of these lines :–

   (a)

(5,12)
(0,2)

   $\boxed{V = \dots t + \dots}$

   (b)

(3,9)
(0,6)

   $\boxed{P =}$

   (c)

(2,9)
(0,-1)

   $\boxed{Q =}$
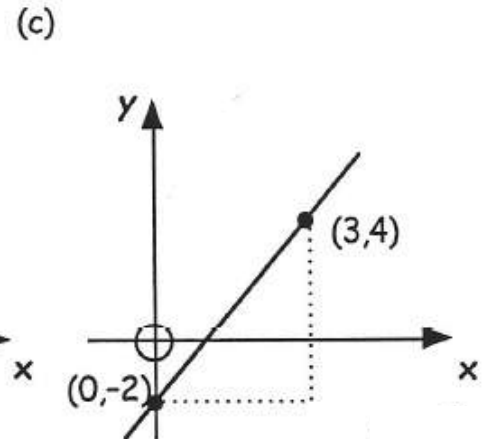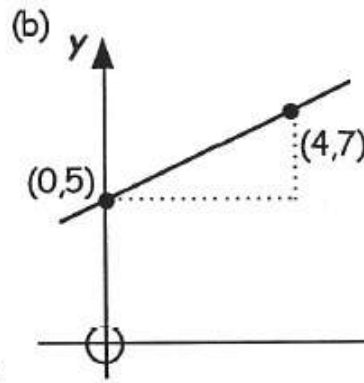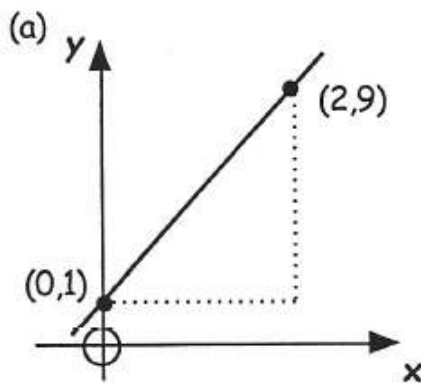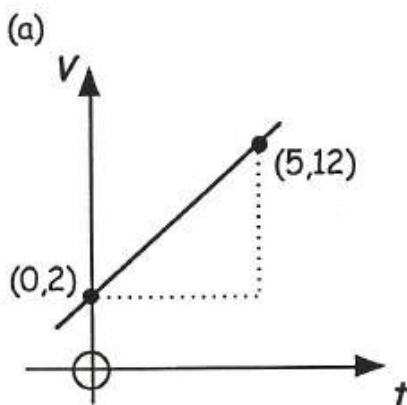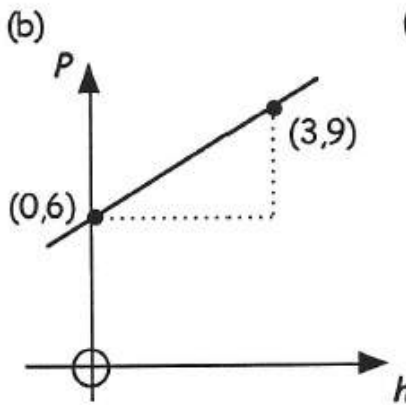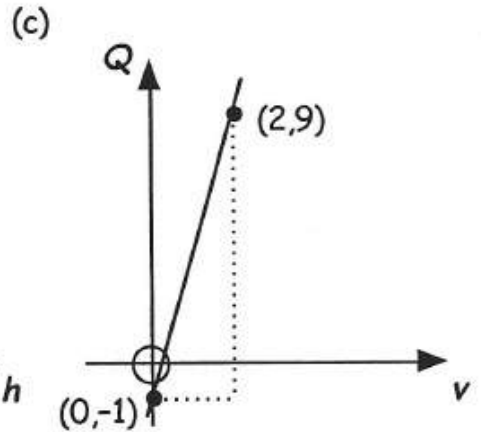
Exercise 5

1. This table shows the cost of hiring a motor cycle for several days.

No. of Days hired (D)	1	2	3	4	5	6
Cost in £'s (C)	12	20	28	?	?	?

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(a)   How much will it cost to hire a motor cycle for (i) 6 days   (ii) 1 week ?

(b)   How much **extra** does it cost for each additional day of hire ?

(c)   Write down the formula for determining the cost of hiring the motor cycle.

(d)   How much will it cost to hire a motor cycle for 10 days ?

(e)   Mrs Able paid £116 to hire a motor cycle. For how many days had she hired it ?

2. This chart shows the distance covered by a train during a 7 hour journey.

   (a) How far did it travel in :-

      (i)   1 hour ?
      (ii) 2 hours ?
      (iii) 7 hours ?

   (b) Find the gradient of the line.

   (c) Write down the equation of the line. (D = ...)
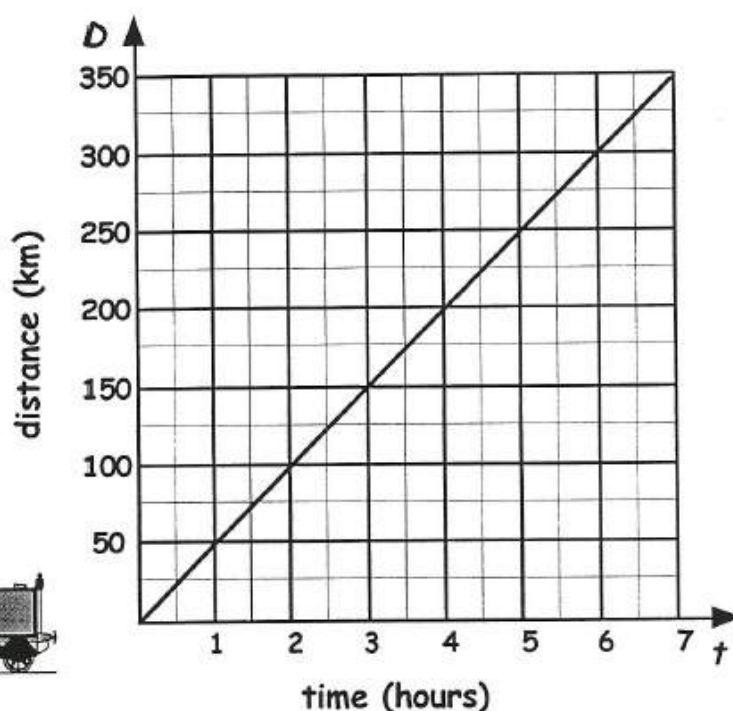
3. This graph shows the cost (£C) of hiring a ladder for (d) days.

   (a) How much does it cost to hire it for 3 days ?

   (b) Calculate the gradient of the line.

   (c) Write down the equation

   $$C = ...d + ...$$

   (d) Use your formula from (c) to find the cost of hiring it for a fortnight (14 days).
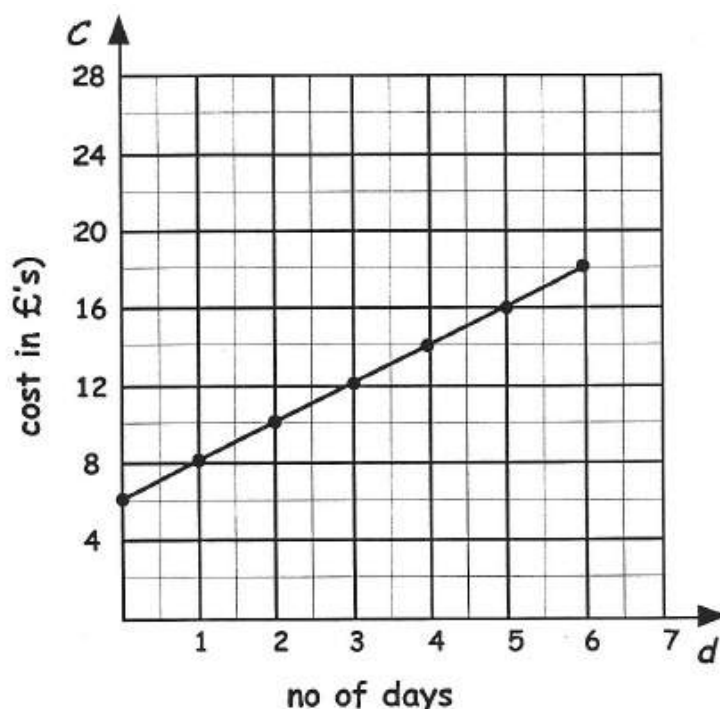
Exercise 6

1. For each data set, construct a scattergraph and draw a line of best fit :-

Engine size (1000cc)	1·1	1·1	1·1	1·4	1·4	1·4	1·6	1·6	1·6	1·8	1·8	1·8	2·0	2·0
km / litre	50	60	55	50	40	45	40	30	35	35	25	30	30	20

(b)

Age (years)	5	6	6	7	7	8	9	9	9	10	10	10	11	11	12	12	12	12
Javelin throw (m)	4	5	6	7	5	6	6	8	9	11	12	9	10	11	14	18	15	12

2. This table shows the connection between the weights of a group of women and their dress sizes.

Weight (kg)	40	60	64	70	50	60	48	44	64	68	74	76	42	42	72
Dress size	6	12	14	18	10	14	8	10	16	16	16	20	6	8	16

(a) Neatly draw the set of axis showing weights from 40 kg to 80 kg and dress sizes from size 6 to size 20.

(b) Neatly plot the information about the 15 women in your graph.

(c) Draw the line of best fit, trying to have as many points above as there is below the line.

(d) From your line, estimate the **size of dress** worn by Millie who weighs 54 kilograms.
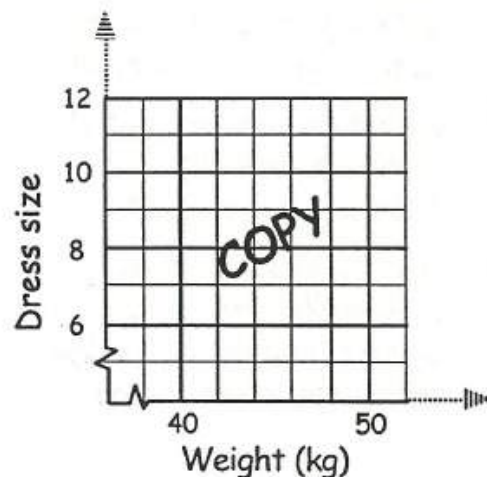
MNU 4-14a: Having explored the distributive law in practical contexts, I can simplify, multiply and evaluate simple algebraic terms involving a bracket.

Exercise 1

1. Multiply out the brackets :-

(a) $3(x + 2)$ (b) $4(t + 4)$ (c) $5(a - 1)$ (d) $10(w - 2)$

(e) $2(2a + 1)$ (f) $3(4e + 5)$ (g) $7(2g - 1)$ (h) $8(2h + 4g - 1)$

2. Remove these brackets :-

(a) $-2(a + 3)$ (b) $-5(6 + 2c)$ (c) $-3(5 - 4g)$ (d) $-(4a - 6)$

(e) $x(x + 4)$ (f) $t(2t - 5)$ (g) $-p(5p + 2)$ (h) $-k(-3 + 6k - m)$

(i) $2y(3y + 1)$ (j) $4x(3x - 7)$ (k) $-2w(7 + 3w)$ (l) $-4p(6p - 2 + k)$.

3. Find the areas of each shape below :-

(a)

3

x + 4

(b)

4

3x – 1
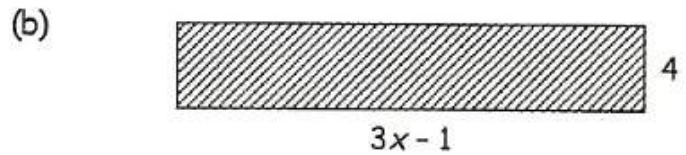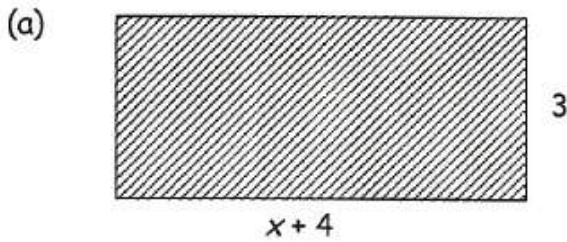
Exercise 2

Multiply out the brackets and simplify :-

1. (a) $2(x + 3) + 1$
   (b) $3(y + 4) + 5$
   (c) $7(k - 1) + 10$
   (d) $5(t - 2) - 5$
   (e) $3(2g + 4) + 8$
   (f) $4(w + 1) - 4w$.

2. (a) $2(f + 3) + 3(f + 1)$
   (b) $4(y + 2) + 7(y + 1)$
   (c) $6(b + 3) + 2(b - 5)$
   (d) $5(2g + 2) + 4(g - 3)$
   (e) $7(p + 3) - 5(p + 1)$
   (f) $7(2q + 3) - 4(3q - 5)$
   (g) $12 - 3(2b + 4)$
   (h) $4(3p - 4) - 3(4p - 5)$
   (i) $5u(2u + 3) - 2u(u - 7)$.

Exercise 2E

Expand:

1. (a) $(x + 1)(x + 3)$
   (b) $(x - 2)(x + 4)$
   (c) $(x + 3)(x - 3)$
   (d) $(x - 7)(x - 5)$
   (e) $(2x + 1)(x + 3)$
   (f) $(x - 4)(4x + 9)$
   (g) $(3x - 2)(2x + 5)$
   (h) $(3x - 2)(2x + 5)$
   (i) $(x + 7)(4 - x)$
   (j) $(x - 2)(5 - x)$
   (k) $(x + 12)^2$
   (l) $(x - 4)^2$
   (m) $(7 - x)^2$
   (n) $(3x - 2)^2$
   (o) $(x + 1)(x^2 + 3x - 5)$
   (p) $(x + 3)(x^2 - 4x - 2)$

2. Find the area of each shape below:
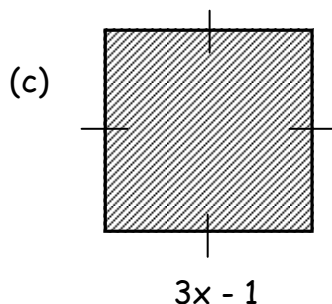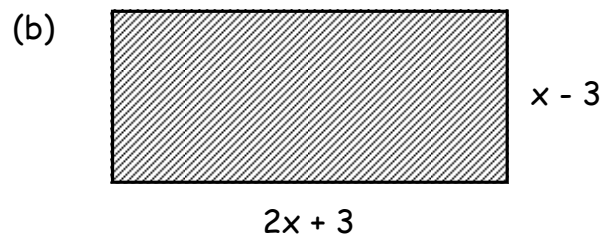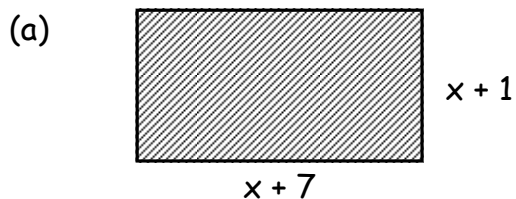
(a)

x + 1

x + 7

(b)

x – 3

2x + 3

(c)

3x – 1

Exercise 1

1. Factorise :-

   (a) $2a + 4$

   (b) $3x + 12$

   (c) $5k - 40$

   (d) $6p + 6q$

   (e) $12x + 15$

   (f) $16y + 24$

   (g) $24k - 15$

   (h) $9a + 21b$

   (i) $3x + 9y + 6$

   (j) $4d + 6e + 10f$

   (k) $12w + 30h - 18$

   (l) $15q - 45p + 75m.$

2. Factorise fully :-

   (a) $3ab + 21b$

   (b) $12cd + 15c$

   (c) $30pqr - 24pq$

   (d) $5x - 15xy + xz$

   (e) $x^2 + 4x$

   (f) $3y^2 + 6y$

   (g) $8x^2 + 4x$

   (h) $12y - y^2$

   (i) $x^2 + x$

   (j) $12x^2 + 4x$

   (k) $x^3 + x$

   (l) $y^3 + y^2 + y.$

Exercise 2E

1. Use the difference of two squares to factorise:-

   (a) $x^2 - 1$

   (b) $x^2 - 16$

   (c) $x^2 - 100$

   (d) $4 - x^2$

   (e) $169 - g^2$

   (f) $16h^2 - 25$

   (g) $49 - 25q^2$

   (h) $81m^2 - 225n^2$

2. Factorise fully:-

   (a) $5x^2 - 20$

   (b) $36x^2 - 9$

   (c) $18 - 8x^2$

   (d) $x^3 - 49x$

   (e) $4x^3 - 4x$

   (f) $3x - 147x^3$

   (g) $x^3y - xy^3$

   (h) $3x^2y - 27y^3$

Exercise 3E

1. Factorise:-

   (a) $x^2 + 3x + 2$

   (b) $x^2 + 5x + 6$

   (c) $x^2 + 6x + 9$

   (d) $x^2 + 7x + 12$

   (e) $x^2 - 12x + 20$

   (f) $x^2 - 5x + 14$

   (g) $x^2 - 10x + 24$

   (h) $x^2 - 20x + 100$

   (i) $x^2 + 8x - 20$

   (j) $x^2 - x - 20$

   (k) $x^2 + 11x - 26$

   (l) $x^2 + x - 12$

   (m) $x^2 - 3x - 70$

   (n) $x^2 + 25x - 26$

   (o) $x^2 - 7x + 60$

   (p) $x^2 - x - 420$

2. Factorise:-

   (a) $15 - 2x - x^2$

   (b) $27 + 2x - x^2$

   (c) $36 - 9x - x^2$

   (d) $2x^2 + 11x + 5$

   (e) $2x^2 + 5x + 2$

   (f) $3x^2 - 7x + 6$

   (g) $4x^2 + 20x + 9$

   (h) $3x^2 + 2x - 8$

Exercise 4E

1. Factorise **fully**:-

    (a) $12 - 2b$

    (b) $h^2 - 7h + 10$

    (c) $2x^2 + 12x + 18$

    (d) $pq^2 - 2p^2q$

    (e) $3x^2 - 12y^2$

    (f) $12r - 4rt$

    (g) $x^3 - 5x^2 - 36x$

    (h) $2j^2 - 14j - 36$

    (i) $35 - 28a - 7a^2$

    (j) $x^5 - x^3$

    (k) $28 - 7g^2$

    (l) $xy^2 + 3xy - 10x$

MNU 4-15a: Having discussed the benefits of using mathematics to model real-life situations, I can construct and solve inequalities and an extended range of equations.

Exercise 1

1. Find the value of x in the following equations (*Show each step of working carefully*).

    (a) $4x + 1 = 21$

    (b) $3x + 5 = 29$

    (c) $9x - 3 = 15$

    (d) $7x - 6 = 29$

    (e) $6x - 12 = 0$

    (f) $5x - 1 = 44$

    (g) $9x - 20 = 34$

    (h) $3x + 42 = 87$

    (i) $2x - 7 = 32$

    (j) $9x + 9 = 0$

    (k) $2x - 19 = 0$

    (l) $3x + 5 = -7$.

2. Solve the following equations :-

    (a) $5x + 3 = 3x + 5$

    (b) $8x + 9 = 7x + 17$

    (c) $7x - 1 = 3x + 15$

    (d) $5x - 3 = 2x + 18$

    (e) $12x - 5 = 8x + 7$

    (f) $10x - 1 = 8x + 6$

    (g) $10x = 9x + 41$

    (h) $3x = x + 17$

    (i) $5x - 26 = 3x$

    (j) $7x - 48 = x$

    (k) $3x + 17 = x$

    (l) $10x - 30 = 6x$.

Exercise 2

Solve for x :-

1. $\frac{1}{2}x - 3 = 1$

2. $\frac{1}{4}x + 7 = 10$

3. $\frac{1}{8}x - 5 = 0$

4. $\frac{2}{3}x - 1 = 9$

5. $1 + \frac{3}{5}x = 13$

6. $\frac{3}{8}x + 4 = 4$

7. $\frac{x + 1}{4} = 3$

8. $\frac{x + 4}{5} = 4$

9. $\frac{x + 2}{3} - 2 = 5$

Exercise 3

1. Solve these inequalities, leaving your answers in the form $x < 1$, etc. :-

    (a) $x + 4 > 7$

    (b) $x + 8 < 14$

    (c) $x - 9 \leq 20$

    (d) $9x \geq 54$

    (e) $7x \leq 98$

    (f) $100x > 1400$

2. Solve the following inequalities :-

(a) $3x + 5 < 23$

(b) $2x + 11 > 27$

(c) $6x - 8 < 4$

(d) $7x + 3 \geq 52$

(e) $10x - 9 \leq 81$

(f) $5x - 23 > 7$

(g) $4x + 4 \leq 4$

(h) $3x - 2 < 25$

(i) $2x + 5 \leq 22$

Exercise 4E

1. Solve these equations by multiplying out the brackets first :-

(a) $2(x + 7) = 18$

(b) $3(x + 4) = 30$

(c) $5(x - 6) = 10$

(d) $4(x + 9) = 48$

(e) $6(x + 3) = 66$

(f) $2(x + 5) = 18$

(g) $9(x - 4) = 36$

(h) $9(x + 1) = 9$

(i) $2(x - 1) = 11$

2. Solve these equations :-

(a) $2(4x + 3) = 14$

(b) $5(2x - 1) = 45$

(c) $3(6x - 1) = 33$

(d) $2(7x + 4) = 50$

(e) $3(2x - 8) = 0$

(f) $4(5x - 8) = 88$

(g) $2(3x - 1) = 4x + 14$

(h) $5(2x + 1) = 7x + 14$

(i) $3(1 + 2x) = 5x + 17$

3. Solve the equations :-

(a) $2(x + 5) - x - 4 = 7$

(b) $4(x + 2) + 3x - 3 = 12$

(c) $3(x - 3) + 2(x + 5) = 21$

(d) $5(2x + 1) - 2(x - 2) = 6x + 13$

4. Solve the equations by multiplying out brackets first:

(a) $(x + 5)(x + 1) = x(x + 1)$

(b) $(x + 4)(x - 4) = (x - 4)(x + 2)$

(c) $(x + 2)(x - 3) = x(x - 5)$

(d) $(x + 5)(x - 3) - (x - 1)^2 = 4$

Exercise 5E

Change the subject of each formula to the letter shown in brackets. SHOW ALL WORKING!

1. $x + v = w$ (x)

2. $\dfrac{P}{3} = q$ (P)

3. $\dfrac{x}{p} = r$ (x)

4. $mx = n$ (x)

5. $2x + r = s$ (x)

6. $vx - w = t$ (x)

7. $x^2 = a$ (a)

8. $T = \dfrac{D}{S}$ (S)

9. $w - p = q$ (p)

10. $2h - 5p = q$ (h)

11. $A = \pi r^2$ (r)

12. $m = 2(n + 1)$ (n)

MNU 4-16a: I have explored the relationships that exist between the sides, or sides and angles, in right-angled triangles and can select and use an appropriate strategy to solve related problems, interpreting my answer for the context.

Exercise 1

1. Find :-

(a) 3^2

(b) 5^2

(c) 2^2

(d) 1^2

(e) 10^2

(f) 9^2 (g) 11^2 (h) 12^2 (i) 20^2 (j) 100^2

(k) $(\frac{1}{2})^2$ (l) $(\frac{1}{3})^2$ (m) $(\frac{1}{5})^2$ (n) $(0.1)^2$ (o) $(0.01)^2$.

2. Calculate the area of a square with side :-

(a) 5 cm (b) 10 cm (c) 7 mm (d) 0.5 m (e) 1 km.

3. Find :-

(a) $\sqrt{36}$ (b) $\sqrt{25}$ (c) $\sqrt{100}$ (d) $\sqrt{169}$ (e) $\sqrt{4}$

(f) $\sqrt{225}$ (g) $\sqrt{10000}$ (h) $\sqrt{900}$ (i) $\sqrt{1600}$ (j) $\sqrt{1}$.

4. Use a calculator and write down to two decimal places :-

(a) $\sqrt{20}$ (b) $\sqrt{50}$ (c) $\sqrt{56}$ (d) $\sqrt{179}$ (e) $\sqrt{14.4}$.

5. Calculate the length of the side of a square with area :-

(a) 49 cm² (b) 81 cm² (c) 9 m² (d) 1 mm² (e) 0.25 m².

Exercise 2

1. For each right angled triangle shown, use **Pythagoras' Theorem** to calculate the length of each hypotenuse :-

(a) (b) (c)
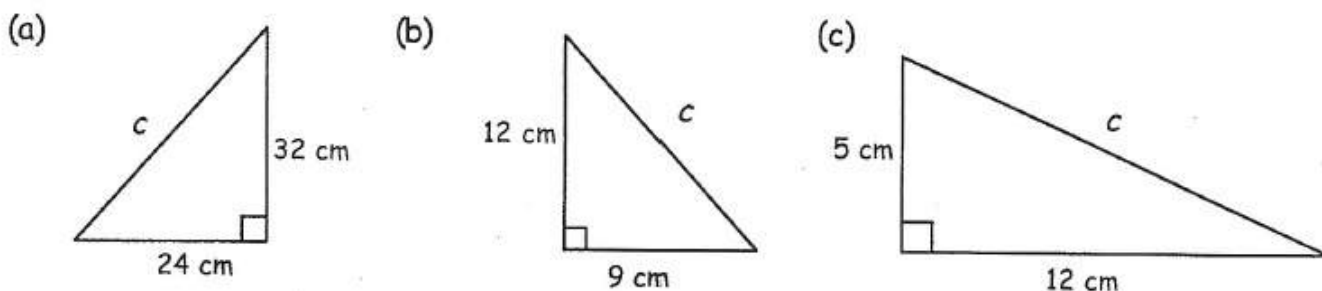
2. For each right angled triangle shown, use **Pythagoras' Theorem** to calculate the length of each hypotenuse (correct to two decimal places) :-

(a) (b) (c)
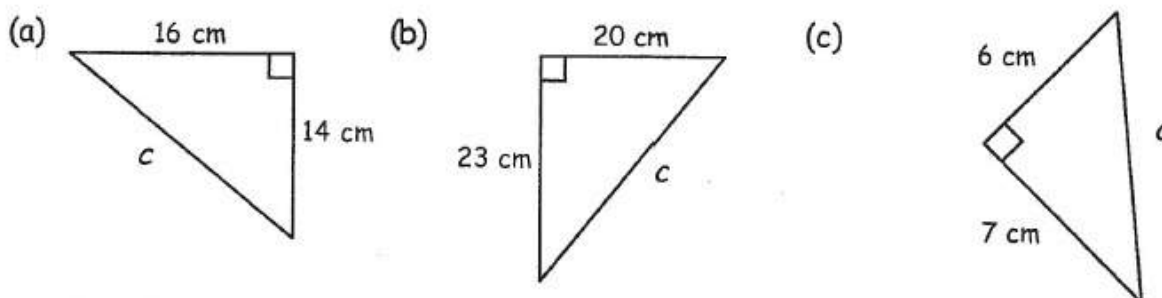
Exercise 3

(In this exercise, round all answers to two decimal places where necessary).

1. A long wooden beam is required to prop up a wall which is deemed unsafe.

   How long is the required beam ?
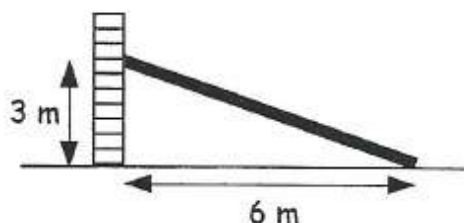
2. A metal wire is attached to the top of a flagpole to help keep it rigid.

   Calculate the length of the metal wire.

   6·5 m

   2·8 m

3.

   2·8 m

   18·6 m
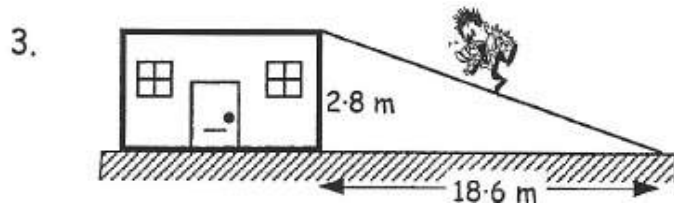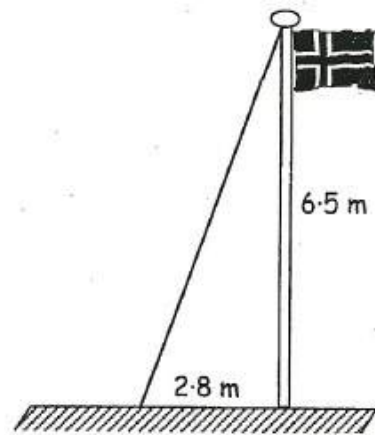
   A tightrope walker is to walk from a roof-top to the ground along a rope.

   Calculate the length of the rope.

4.

   ← 4 m →

   2 m

   ? m

   10 m
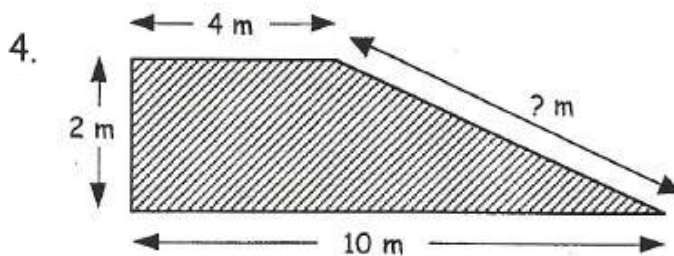
   A skateboard ramp has dimensions as shown.

   Calculate the length of the sloping side of the ramp.

5. A rhombus has its diagonal lengths 20 centimetres and 14 centimetres.

   Calculate the perimeter of the rhombus.

   14 cm

   20 cm
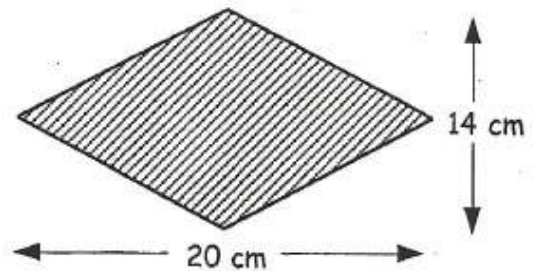
Exercise 4

1. In each of the following right angled triangles, calculate the size of each unknown smaller side :-

   (Give your answer to two decimal places where necessary).

   (a)

   5 cm

   x

   13 cm

   (b)

   7 cm

   15 cm

   w

   (c)

   24 cm

   55 cm

   y
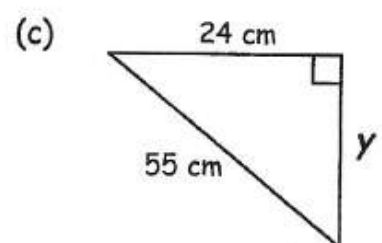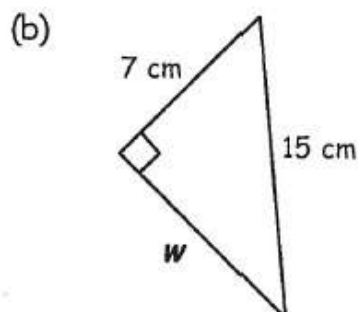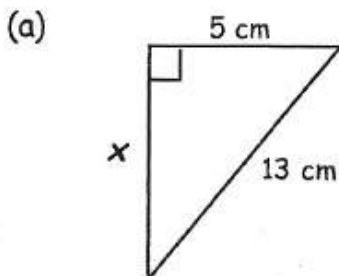
2. A triangular garden has dimensions as shown.

   Find the breadth of the garden.

   ? m

   15 m

   13 m
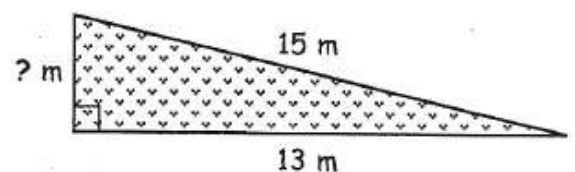
3.
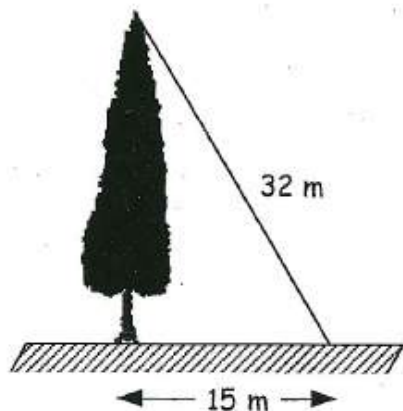
Calculate the height of the tree.

32 m

15 m

Exercise 5

1.
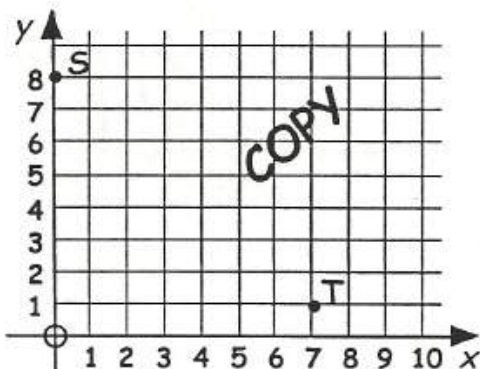
(a) Write down the coordinates of the points S and T.

(b) Copy the figure accurately showing the 2 points, S and T.

(c) Join S to T, complete the right angled triangle and calculate the length of the line ST.

2. (a) Draw your own coordinate diagram measuring 8 boxes across by 8 boxes upwards.

(b) Mark on it the x-axis, the y-axis and the origin.

(c) Plot the 2 points, J(1,3) and K(7,7).

(d) Create a right angled triangle and calculate the length of the line JK.

Exercise 6

1. For each question below, use an appropriate formula to find the values of x, y and z :-

(a)
40 cm

x

70 cm

(b)
y

7 m   8 m

(c)
8·6 cm

15·3 cm

z
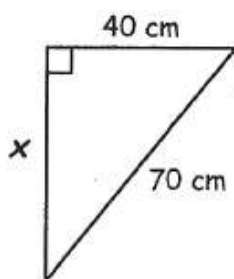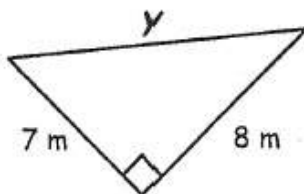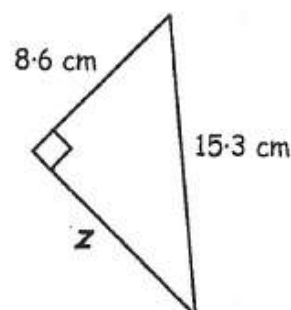
2. The top of a ladder is placed **three quarters** of the way up an eight foot high wall.

Find the length of the ladder.

8 ft

12 ft
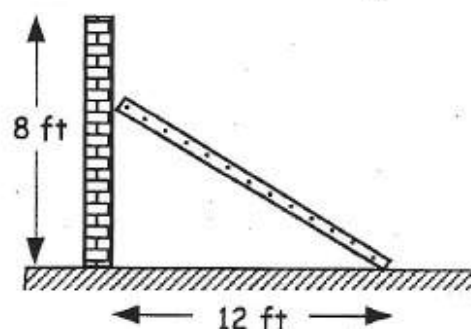
3.
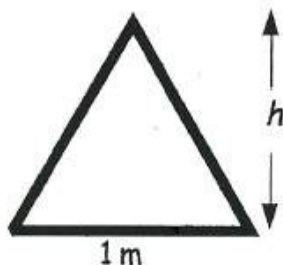
The road sign is in the shape of an equilateral triangle with side 1 metre.

Find the height of the sign (*h* metres).

Exercise 7

1. Use the **Converse of Pythagoras' Theorem** to determine if these triangles are right-angled:-

(a)

12cm
11cm
4cm

(b)

12cm
9cm
15cm

(c)

1.1m
0.6m
0.8m
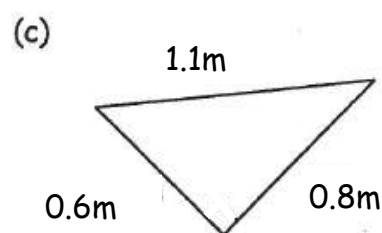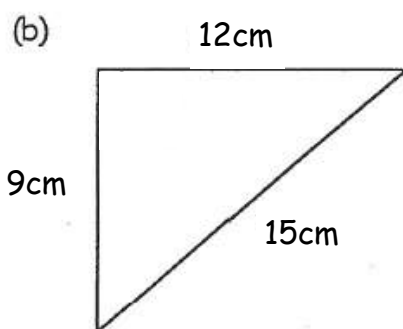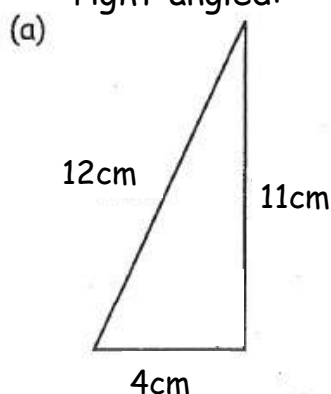
2. After the grass was replaced on the football pitch at Hampden, Shuggie the groundsman paints the lines back on. To check that the new pitch is rectangular, he measures the length of one of the diagonals.

   The pitch is 120 metres long and 90 metres wide. The diagonal is 145 metres in length.

   Is the pitch rectangular? Explain your answer!

90m
145m
120m
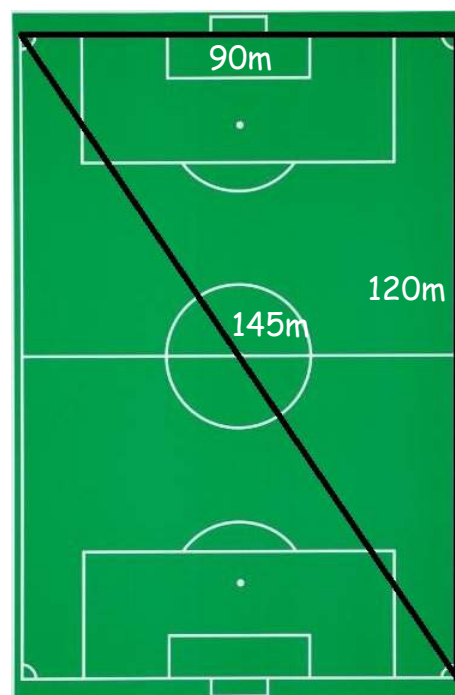
Exercise 8

1. Look at this triangle with angle *x* marked.
   (a) Name the hypotenuse.
   (b) Name the opposite side.
   (c) Name the adjacent side.

C
x
A
B
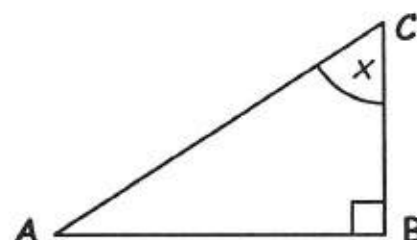
2. Write down the value of sin$x$ (as a fraction) each time here :-

(a)
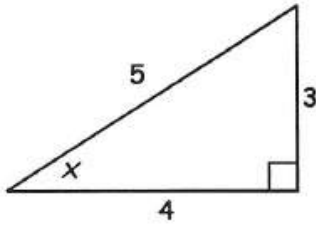
(b)
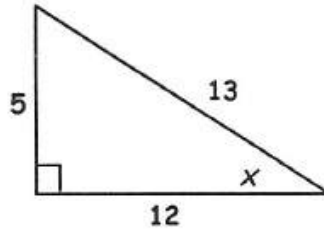
(c)
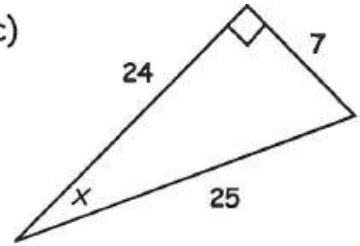
3. Use your | sine | button to write down the value of the following to three decimal places :-

(a) sin15°   (b) sin46°   (c) sin18°   (d) sin65·4°

4. Calculate x each time :-

(a)
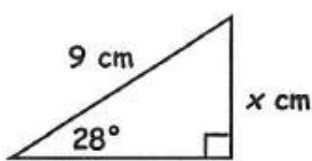
(b)
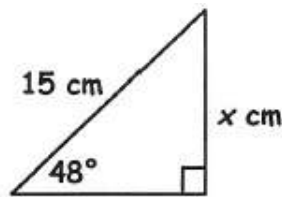
(c)
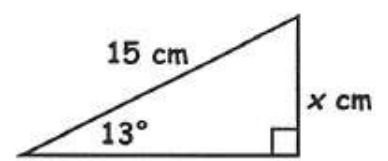
(d)
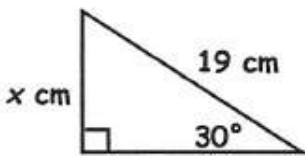
(e)
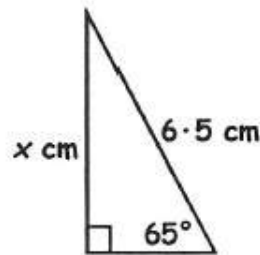
(f)
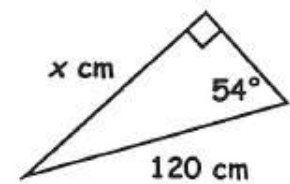
5. A plane flies from O for 180 kilometres to A on a bearing of 065°.

(a) Calculate the size of ∠AOB.

(b) Calculate how far north the plane now is from O.
(i.e. find AB)
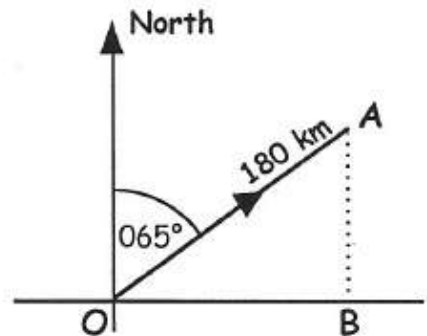
Exercise 9

1. Calculate the size of the angle marked x each time :-

(a)
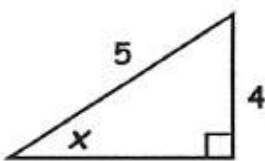
(b)
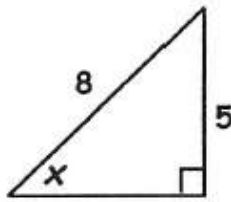
(c)
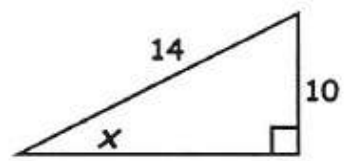
(d)
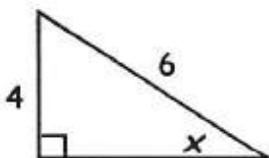
(e)
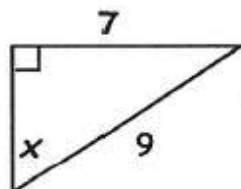
(f)
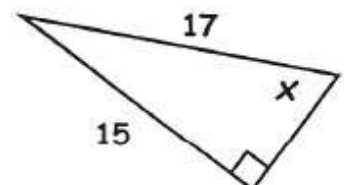
2.   This isosceles triangle △ABC can be
     split into 2 identical right angled triangles.

     AC = BC = 11 cm.

     Height CD = 7 cm.

     (a) Calculate the size of ∠CAD.

     (b) Now calculate the sizes of the
          other 2 angles in △ABC.
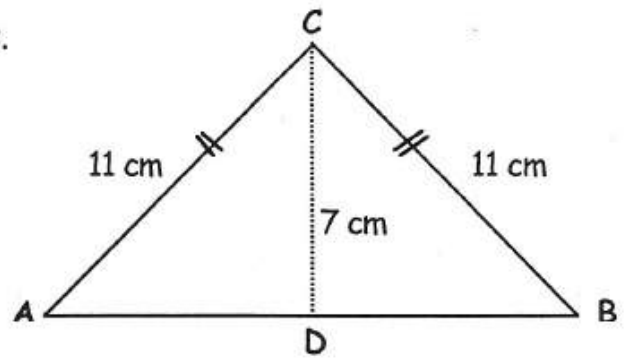
Exercise 10

1. Calculate x each time :-

(a)

12 cm
29°
x cm

(b)

9 cm
51°
x cm

(c)

11 cm
37°
x cm

(d)

x cm
62°   6·5 cm

(e)

120 cm   66°
x cm

(f)

x cm
19·5°
24 cm
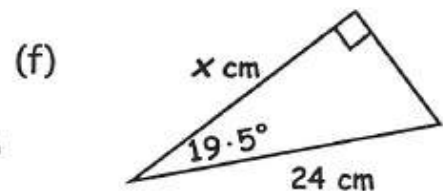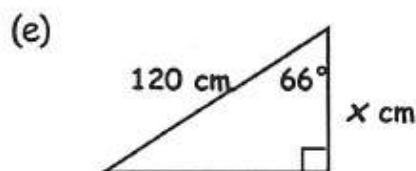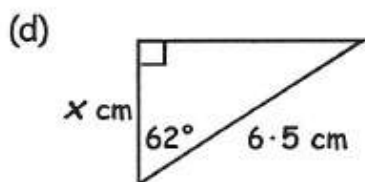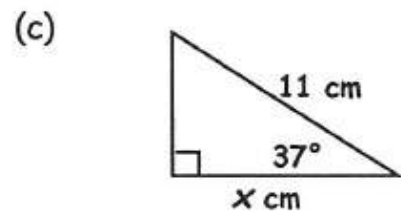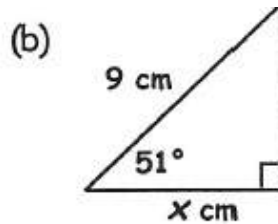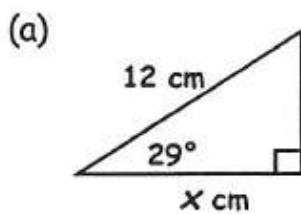
2. A set square has an angle of 30° in one corner.

    One of its sides is 16 centimetres as shown.

    (a) Calculate the length of line DC.
         (to 3 decimal places)

    (b) Now use Pythagoras Theorem to calculate
         the length of BC.

16 cm
30°
D x cm   C
B
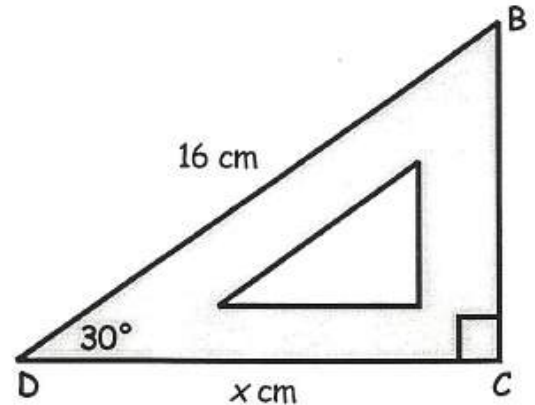
Exercise 11

1. Calculate x each time :-

(a)

x cm
21°
9 cm

(b)

x cm
65°
4 cm

(c)

51°
2·5 cm
x cm

(d)

11 cm
32°
x cm

(e)

x cm
70°   1·2 cm

(f)

103 cm x cm
35°

2. Calculate the size of the angle marked *x* each time :-

(a)

9 cm

x

11 cm

(b)

18 cm

x

16 cm

(c)

6 cm

x

10 cm

(d)

3·2 cm

x

2·3 cm

(e)

125 mm

85 mm

x

(f)

1·2 cm

0·9 cm

x
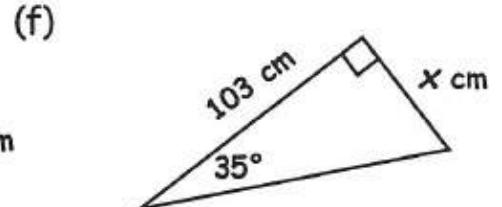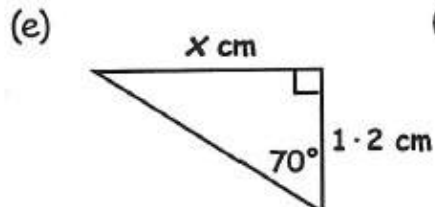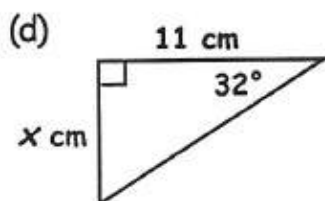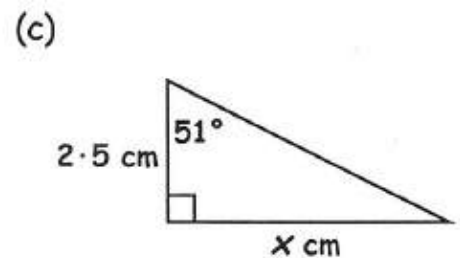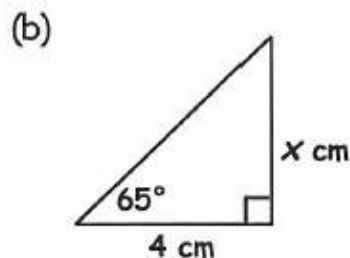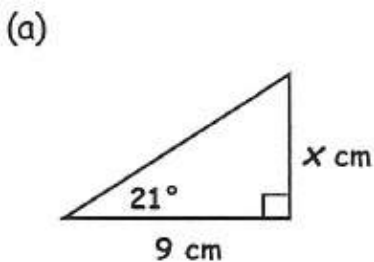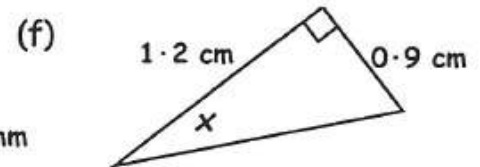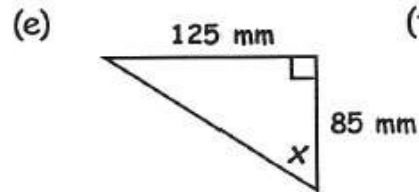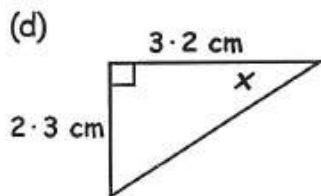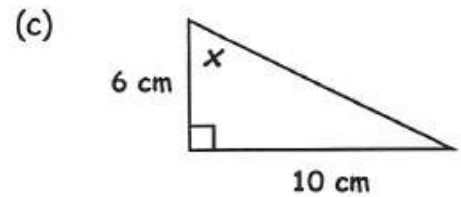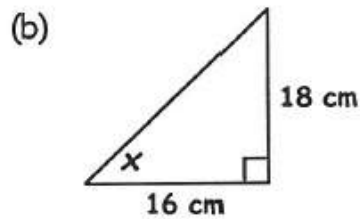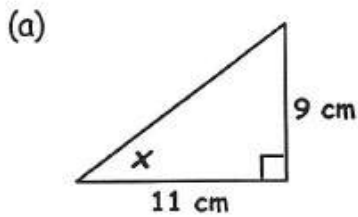
3. This picture shows the side view
of a "lean-to" shed.

Calculate the size of the angle
the roof makes with the horizontal.

roof

2 m

2·8 m

3·5 m
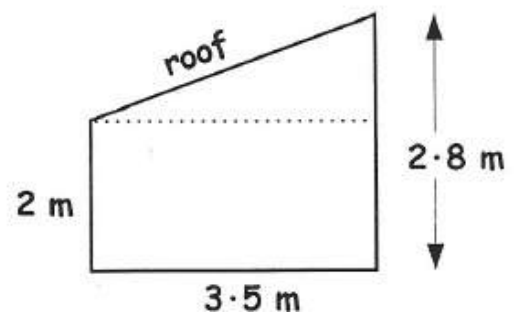
Exercise 12 (A mixture)

In this exercise, you must decide :-

(i) which 2 sides you are dealing with. (opp. hyp, adj)

(ii) which trig ratio to use. (sin, tan, cos)

SOHCAHTOA

1. Calculate *x* each time :-

(a)

8 cm

x cm

34°

(b)

22 cm

41°

x cm

(c)

x cm

29°

17 cm

(d)

12 cm

8 cm

x

(e)

15 cm

8 cm

x

(f)

13·5 cm

x

7 cm
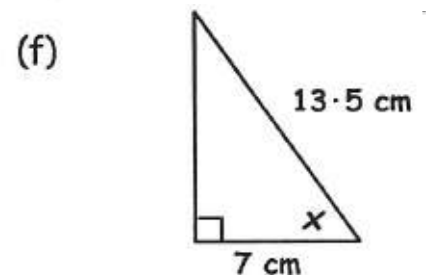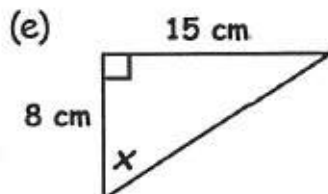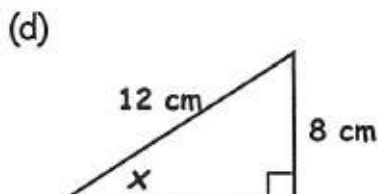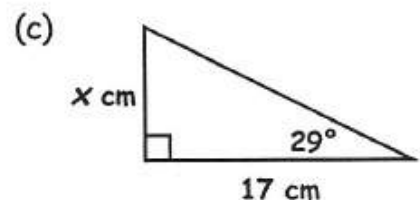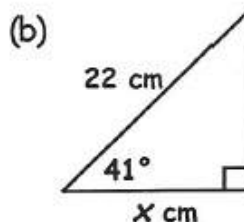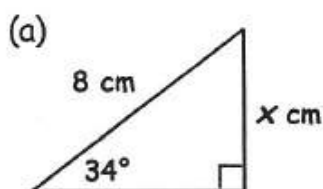
2. The diagonal of this rectangle is 22 cm long.

   (a) Calculate the length of the small side BC.

   (b) Calculate the length of the larger side AB.

D

C

22 cm

28°

A

B
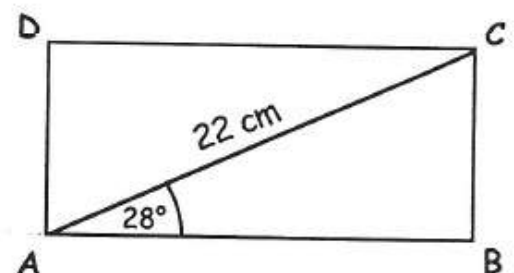
3. This umbrella has a cord joining the end of the handle to one of the "prongs" of the cover.

   Calculate the length of the handle shown.

   cord = 45 cm
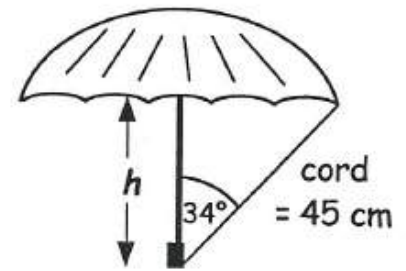
4. A hiker walks 3 km south then 4 km west.

   (a) Calculate the size of the angle marked x.

   (b) Write the 3 figure bearing of the direction he must take from the finish to head back to the start.
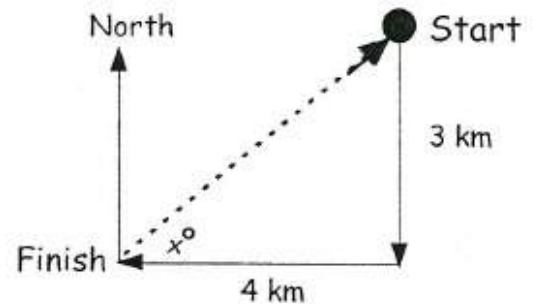
5. A doorway in the shape of an equilateral triangle is to be built for a funhouse.

   (a) Write down the size of each of the three angles of the triangle.

   (b) Use trigonometry to find the height of the doorway.

   (*Show all your working*).
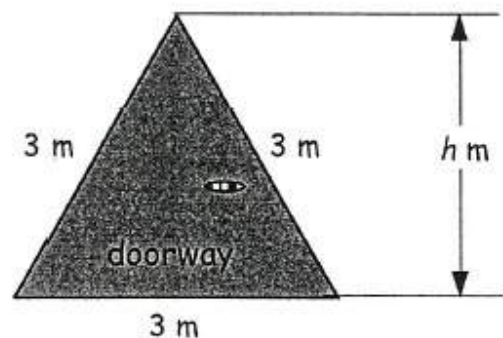
Exercise 13

In each question below: (a) decide whether to use Pythagoras or trigonometry
(b) find the missing side or angle.

1. Find x in each triangle below:-

(a)

(b)

(c)

(d)

(e)
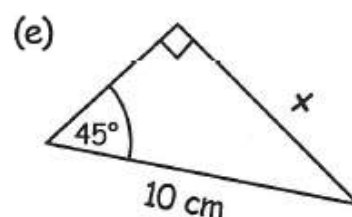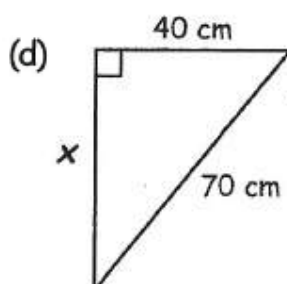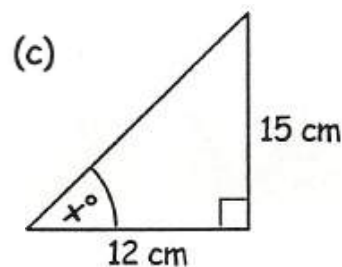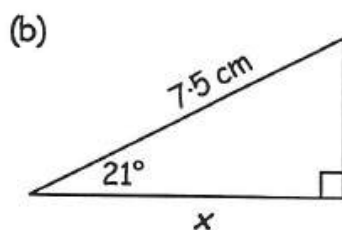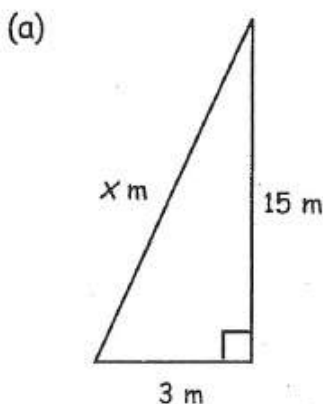
2.
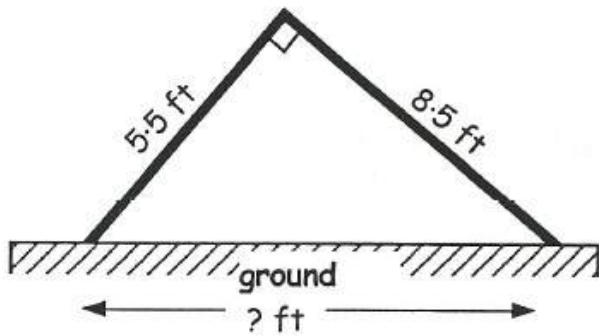
This metal frame, in the shape of a right angled triangle, is placed on the ground ready for a tent canvas to be spread over it.

Calculate the distance, along the ground, between the ends of the 2 metal poles.

3. This pencil lies with its end just resting against a book.

If the pencil is 15 cm long, calculate the size of the angle between the tip of the pencil and the table top.
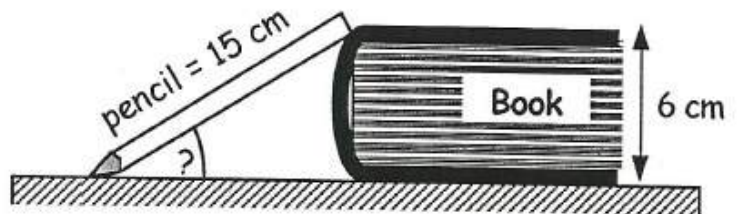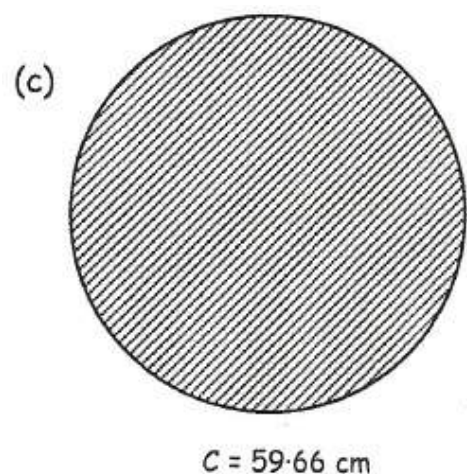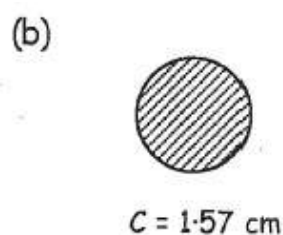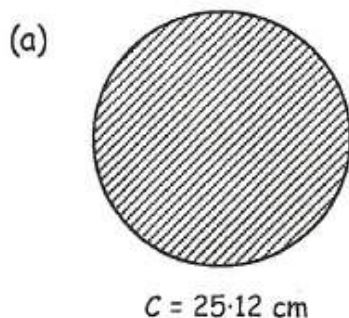

MNU 4-16b: Having investigated the relationships between the radius, diameter, circumference and area of a circle, I can apply my knowledge to solve related problems.

Exercise 1

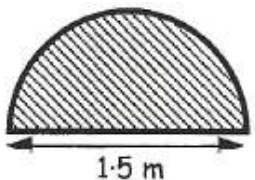**1.** Calculate the circumference of each of these circles:-

(a)

5 cm

(b)

0·2 cm

(c)

10 cm

(d)

0·9 cm
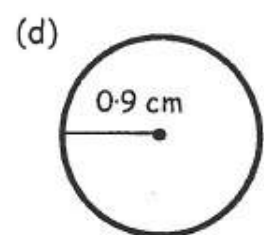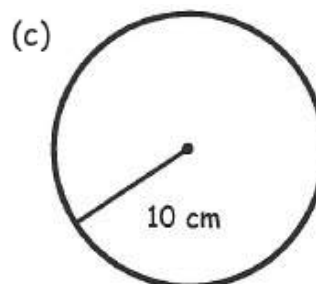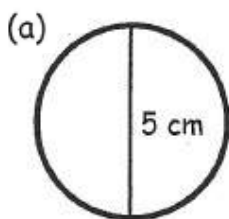
2. Calculate the diameter of each circle below :-

(a)
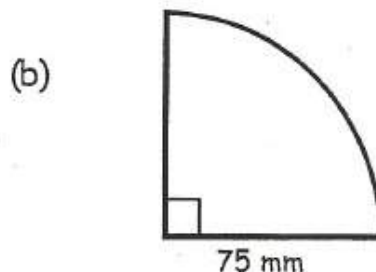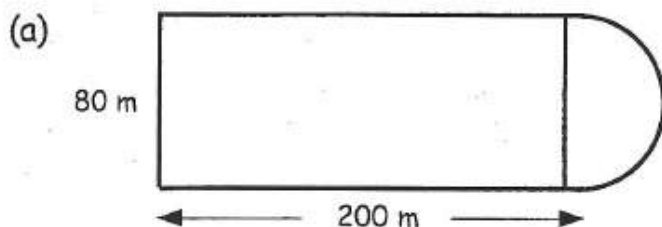

C = 25·12 cm

(b)

C = 1·57 cm

(c)

C = 59·66 cm

3. The circumference of a tyre from a child's toy motorbike is 7·85 centimetres.
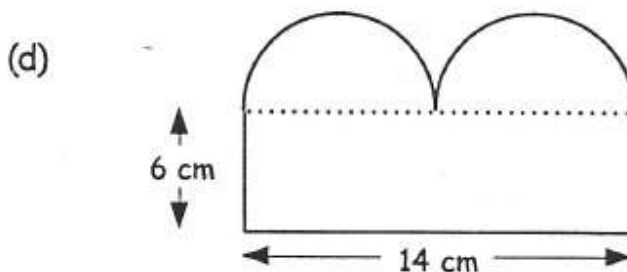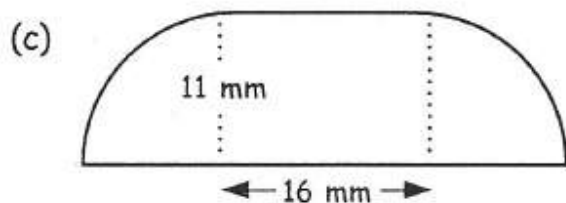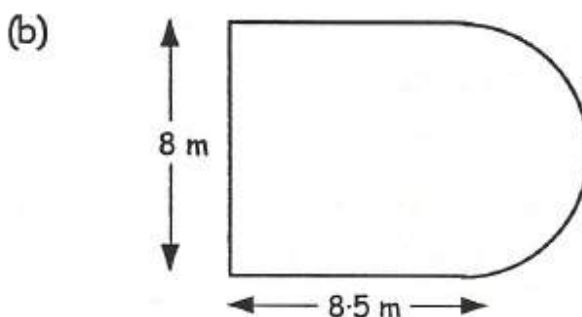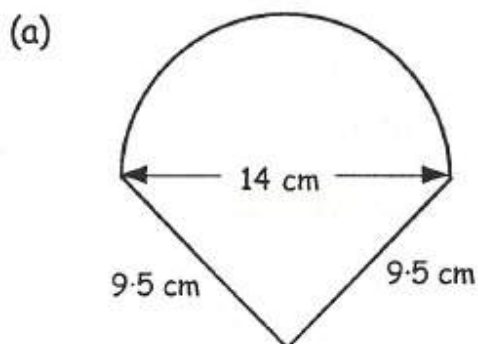
Find the radius of the tyre.

Exercise 2

1. A semi-circular doorstep has a diameter of 1·5 metres.

   Calculate the perimeter of the doorstep.
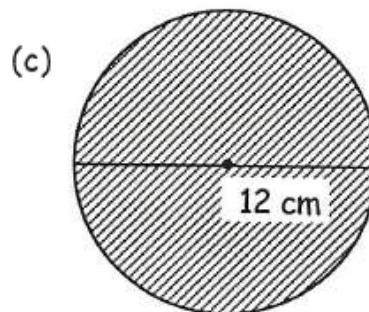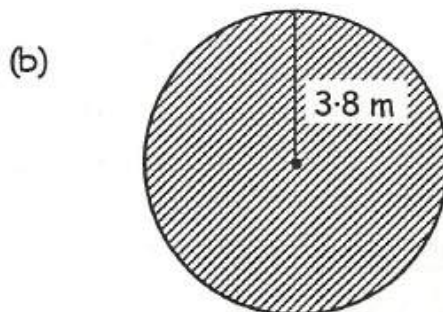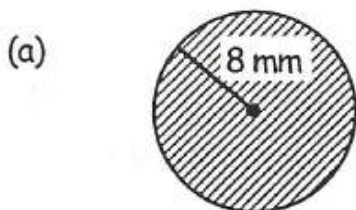
   1·5 m

2. Calculate the perimeter of both shapes :-

   (a)

   80 m

   200 m

   (b)

   75 mm

3. Calculate the **PERIMETER** of each of these shapes :-

   (a)

   14 cm

   9·5 cm   9·5 cm

   (b)

   8 m

   8·5 m

   (c)

   11 mm

   16 mm

   (d)

   6 cm

   14 cm

Exercise 3

1. For following circles, calculate their areas :-

   (a)

   8 mm

   (b)

   3·8 m

   (c)

   12 cm

2. Work out the area of this coloured counter which has diameter 1·8 metres.   (Round your answer to 2 dec. pl.)

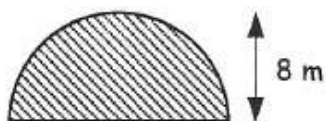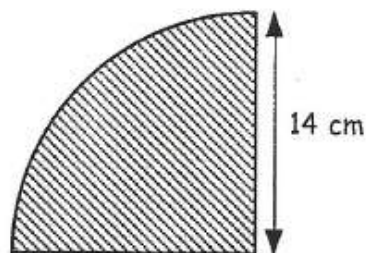3. A ten pence piece has a <u>diameter</u> of 24 mm.

   What is its area ?

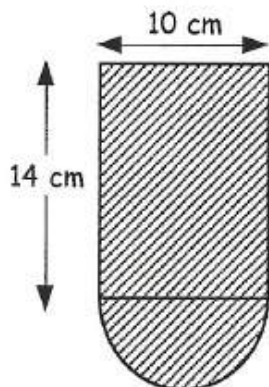**Page 43**
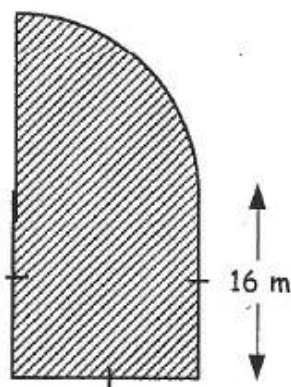
Exercise 4

1. Calculate the area of these shapes :-

   (a)

   8 m

   (b)

   14 cm

2. Calculate the area of these shapes :-
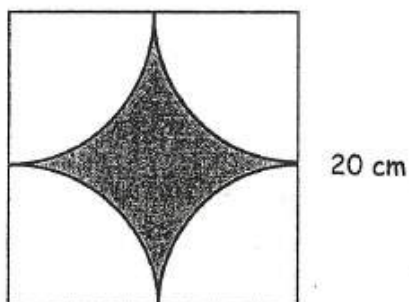
   (a)

   10 cm

   14 cm

   (b)
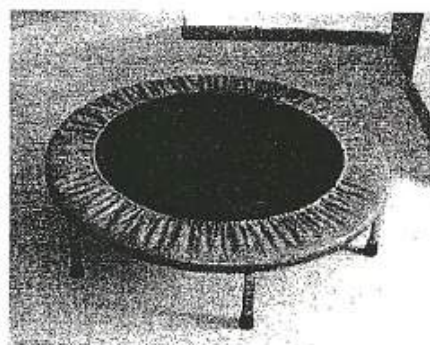
   16 m

3.

   20 cm

   A square with side 20 centimetres has four identical quarter circles cut out from each corner as shown.

   Work out the shaded area.

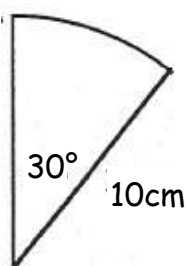4. A circular trampoline has a circumference of 10·99 m.
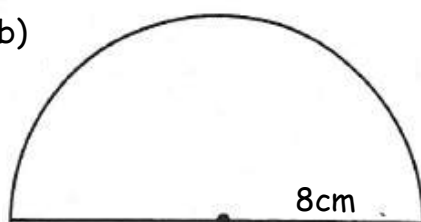
   Calculate its area, to the nearest m².

Exercise 5E

1. Calculate the length of the arc in each diagram:-

   (a)

   30°   10cm

   (b)

   8cm

   (c)

   45°

   12cm

(d)

15cm 80°

(e)

18cm

150°

(f)

320°

8cm
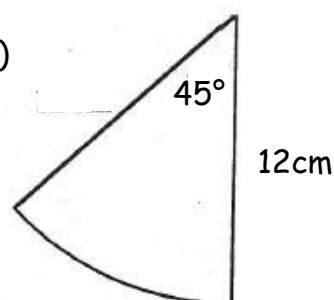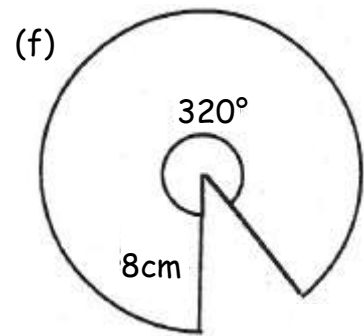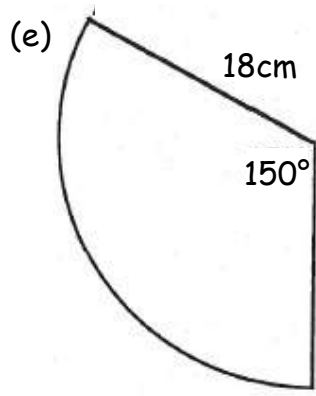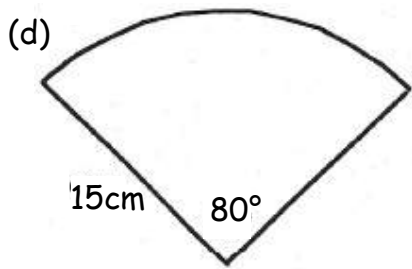
2. The edge of this fan is 48cm long, and is the arc of a circle with a radius of 30cm.

    Find the size of the angle at the centre of the fan (accurate to 1 d.p.)

48cm

30cm
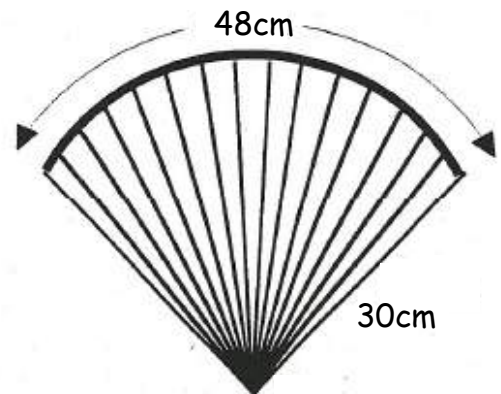
Exercise 6E

1. Calculate the area of the sector in each diagram:-

30° 20cm

15cm

60° 30cm

10cm

130°

18cm

12cm

300°
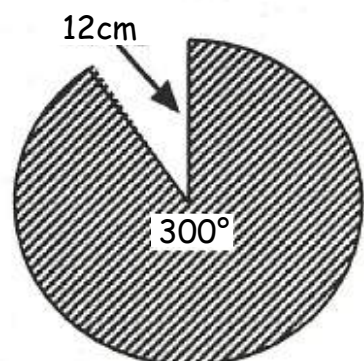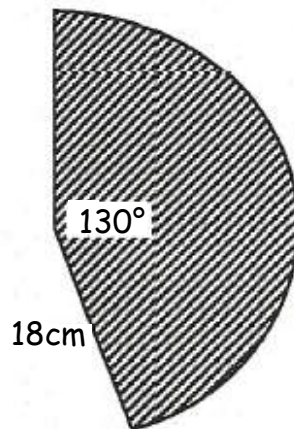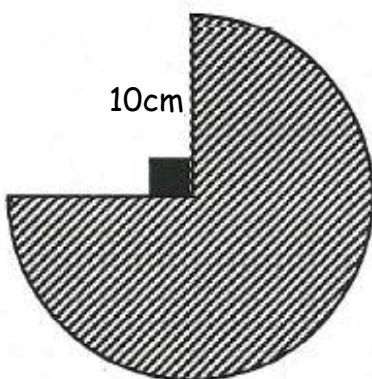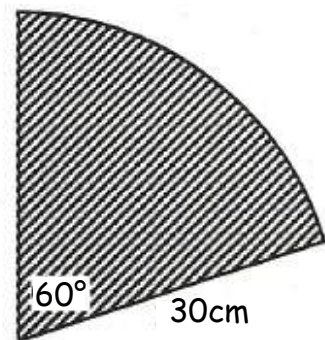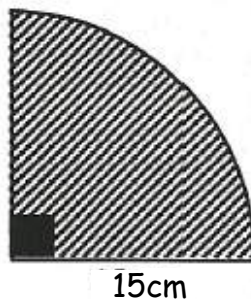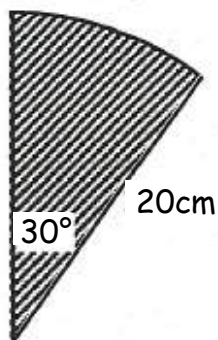
2. A lamp shade is made from the sector of a large circle with a smaller sector removed.

    Calculate the area of the lamp shade.

12cm

16

30cm

30cm

Exercise 1

1. Copy the diagrams below and find the sizes of the angles marked with a letter:-
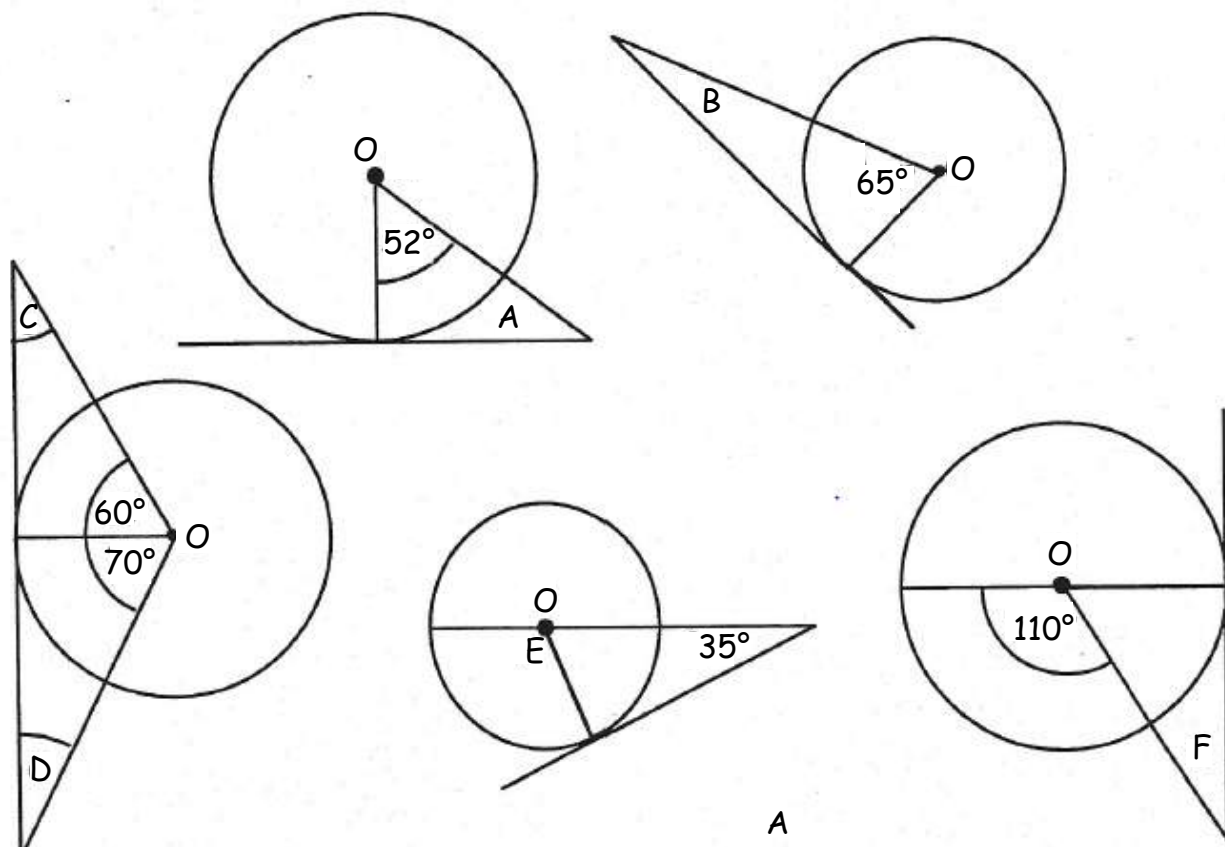
2. AB is a tangent to the circle with centre O.

    It meets the circle at point P.

    Angle CBP = 36°.

    Find the size of angle x.
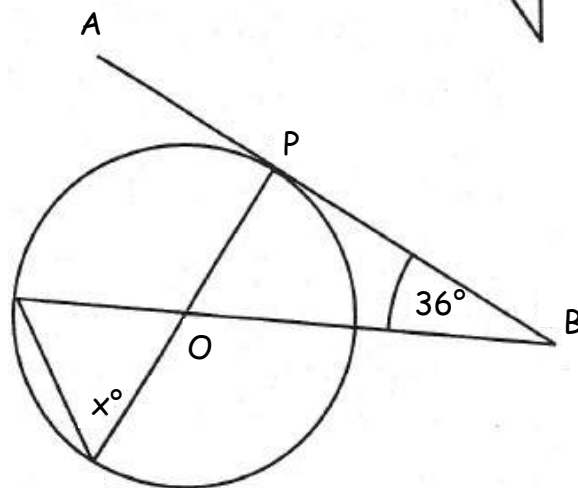
Exercise 2

1, Use Pythagoras' Theorem to find the lengths of a and b (all lengths are in cm).
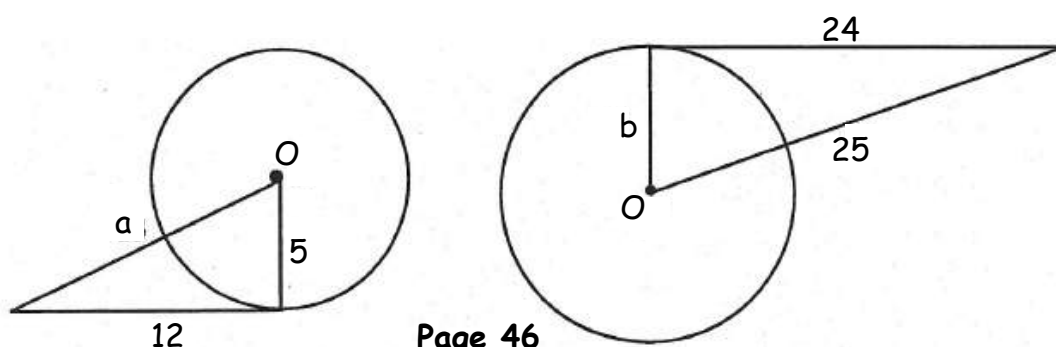
2.   Use trigonometry to find x in each diagram below:-

(a)
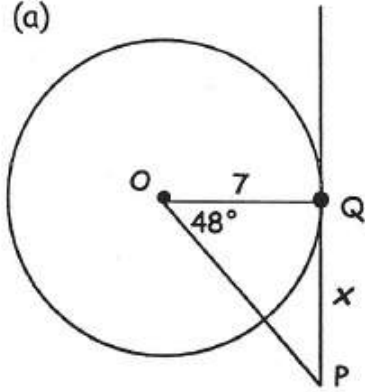
(b)
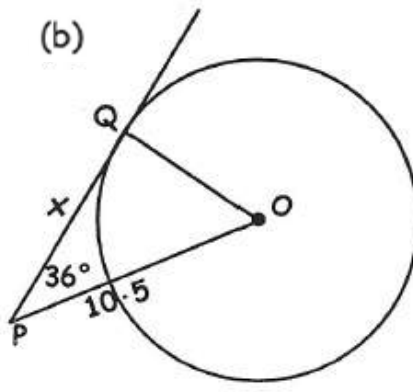
(c)
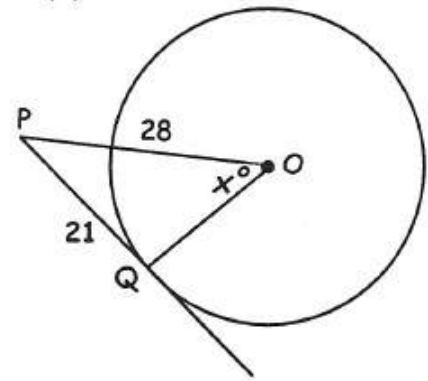
Exercise 3

1.   Make a neat sketch of the following circles, filling in the missing angles :-

(a)
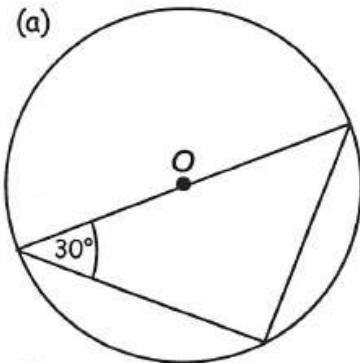
(b)
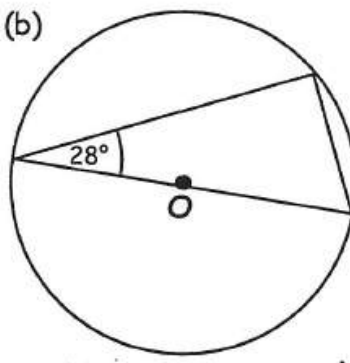
(c)
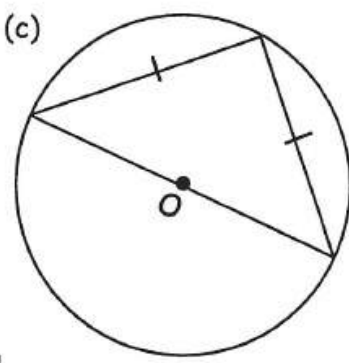
(d)
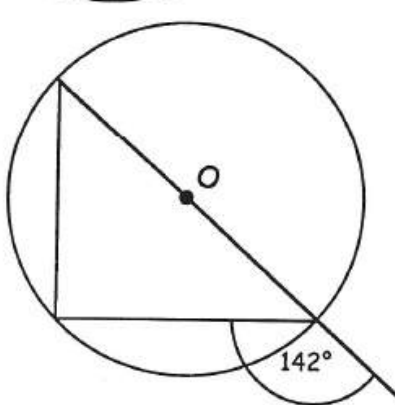
(e)
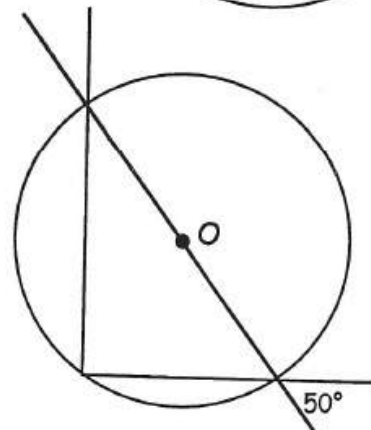
2.   Make a neat sketch of the following circles. Name the 4 sided shapes inside the circles and use their properties to calculate all the missing angles.

(a)
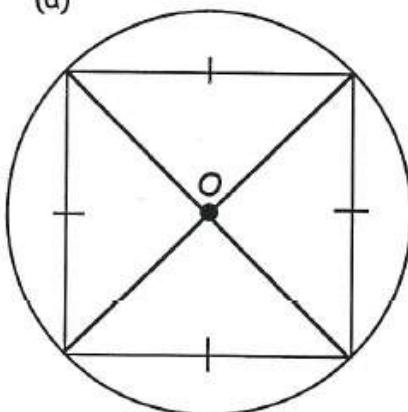
(b)
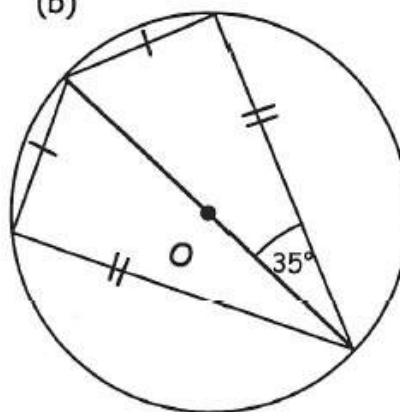
(c)
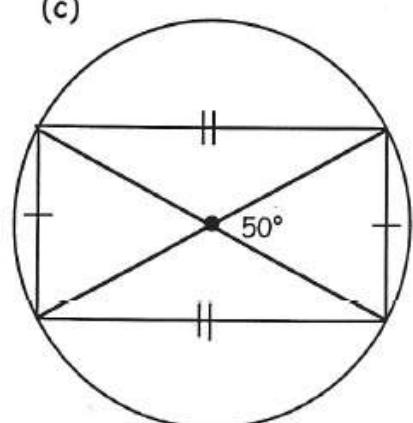
3. For each of the following diagrams, copy the triangle and mark in the right angle before calculating x (correct to 1 decimal place) :-

(a)

(b)

(c)

(d)

(e)

(f)
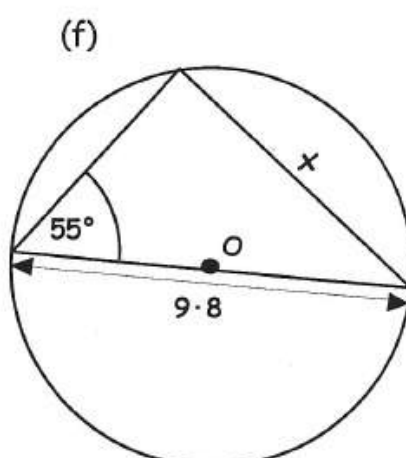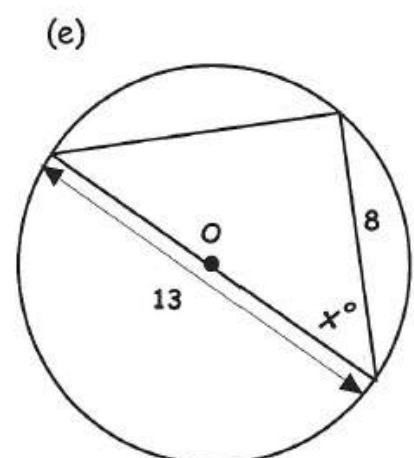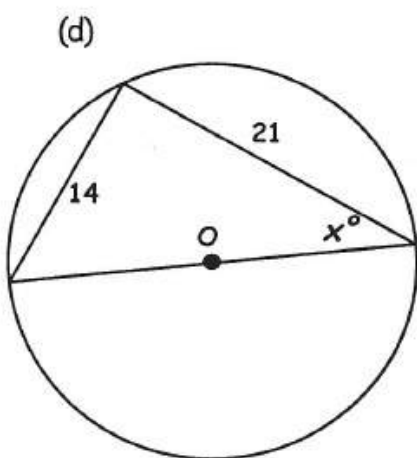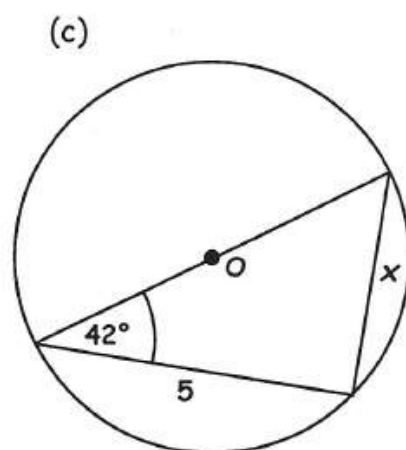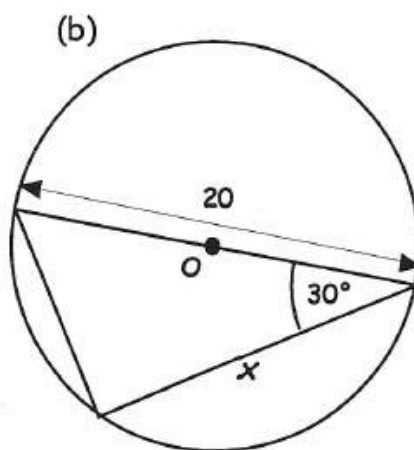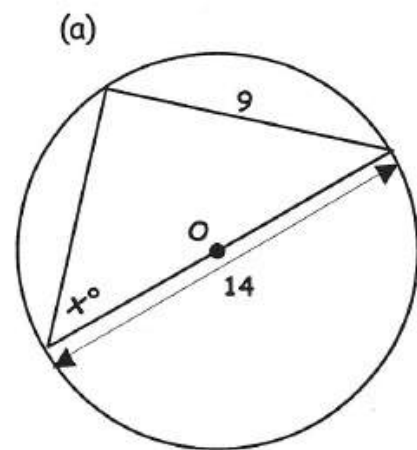
MNU 4-17b: I can apply my understanding of the properties of similar figures to solve problems involving length and area.

Exercise 1

1. These rectangles are similar.

   Compare their sides and write down the **scale factor**.
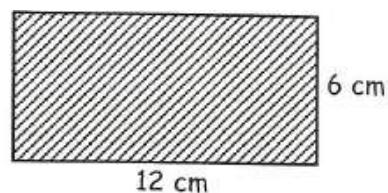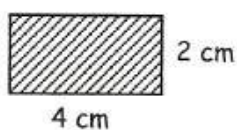
2. In each of the following pairs of **similar** figures, calculate

   (i) the scale factor   (ii) the value of x.

   (a)

   (b)
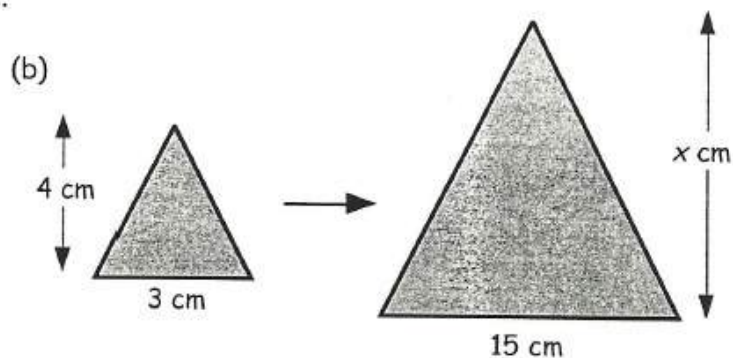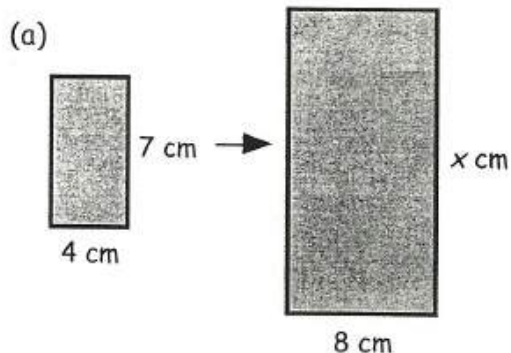
3. Each of the following pairs of right angled triangles are similar.

In each case, find the scale factor and calculate the value of a and b.

(a)

6 cm

5 cm

a cm

30 cm

(b)

10 cm

4 cm

b cm

10 cm
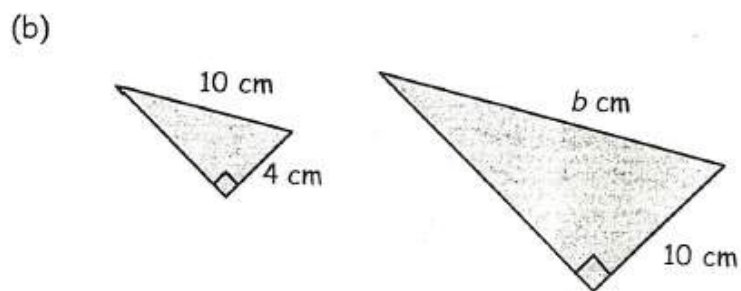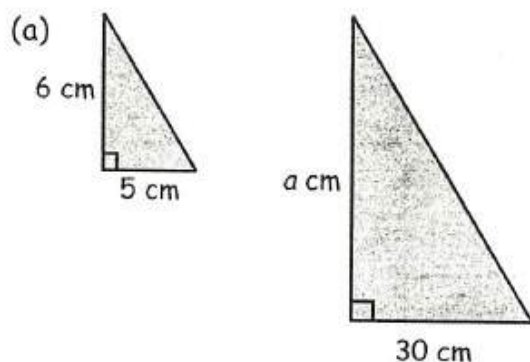
4. Are these two rectangles similar ? (Show all your working).

16 cm

45 cm

2 cm

5 cm
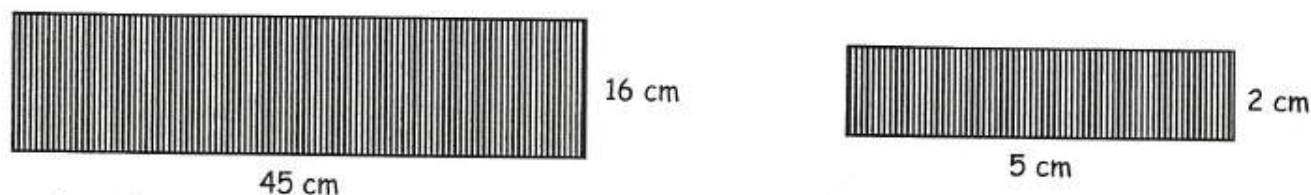
Exercise 2

1. These two rectangles are similar.

   (a) Write down the "length" scale factor. (= 15 ÷ ... = ...)

   (b) Now write down the "area" scale factor (it is **not** 3 !)

   (c) Calculate the area of the larger rectangle.

18 cm^2

5 cm

? cm^2

15 cm

2. The two chocolate box tops are similar.
   The area of the small one is 250 cm^2.

   (a) Write down the length scale factor.

   (b) What is the area scale factor ?

   (c) Calculate the area of the larger box lid ?

CHOCOS

20 cm

CHOCOS

60 cm
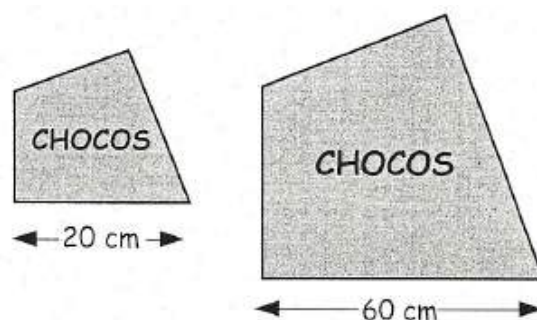
3. The two "L" shapes are similar.
   If the larger one has an area
   of 270 cm^2, calculate the area
   of the smaller one.
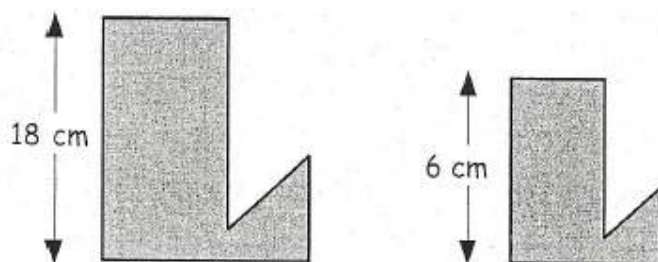
18 cm

6 cm

Exercise 1

1. The coordinates of A are (−3,2).

   Write the coordinates of the other points.

2. (a) Copy the set of axes from question 1.

   (b) Plot the following six points :-

   P(2, 3), Q(−1, 5), R(−4, 3),
   S(−4, −1), T(−1, −3) and U(2, −1).

   (c) Name the shape formed when the six points are joined up in order.

3. (a) Draw a set of axes from −5 to 5 on both axes.

   (b) Plot the points A(3, 2), B(3, −3) and C(−2, −3).

   (c) Find and plot a fourth point (call it D), such that ABCD is a square.

4. (a) Draw a set of axes from −5 to 5 on both axes.

   (b) Plot the points J(2, 1), K(4, 1) and L(3, 4).

   (c) Join the three points and write the name of the shape formed.

   (d) <u>Reflect</u> this shape over the x-axis.

   (e) Write the coordinates of the vertices of the new shape found.

Exercise 1

1. Copy each diagram and shade just enough sections so that the dotted lines are lines of symmetry:-

Page 50
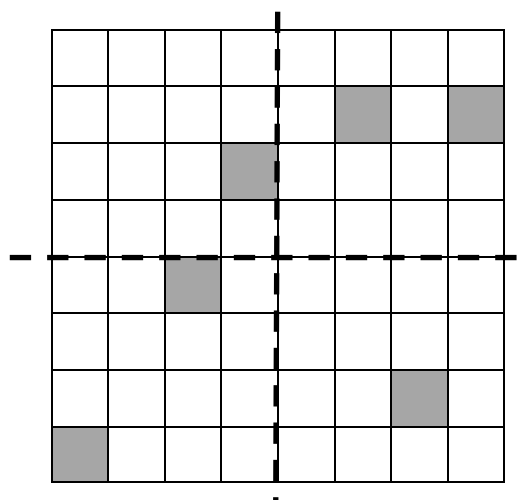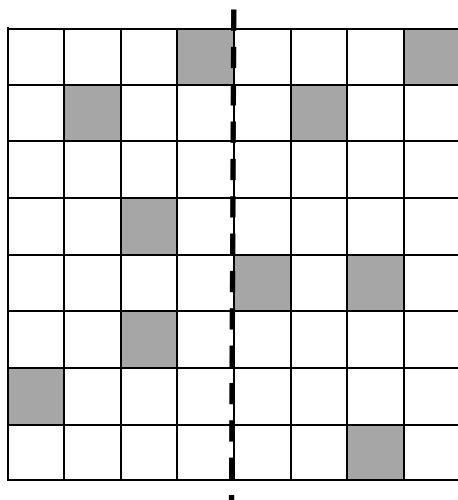
2. A trapezium is drawn with vertices at the points A (-2, 3), B (3, 3), C (5, -1) and D (-4, -1).

(a) (i) Write down the coordinates of A', B', C' and D', the images of A, B, C and D under reflection in the x-axis.

(ii) Copy the axes and draw trapezium A'B'C'D'.

(b) On a separate diagram, draw trapezium A"B"C"D", which is made by reflecting ABCD in the dotted line.
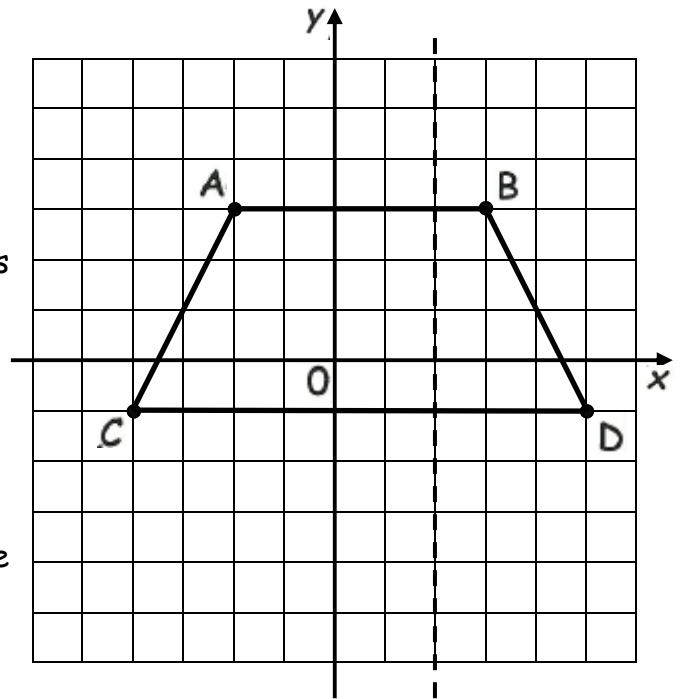
Exercise 2

1. Triangle PQR has been placed on a grid as shown.

(a) Copy the diagram and add the image of PQR under a 90° anti-clockwise rotation about O.

(b) Copy and complete the table:-

Point	Image
P (2, 5)	P' (-5, -2)
Q	Q'
R	R'
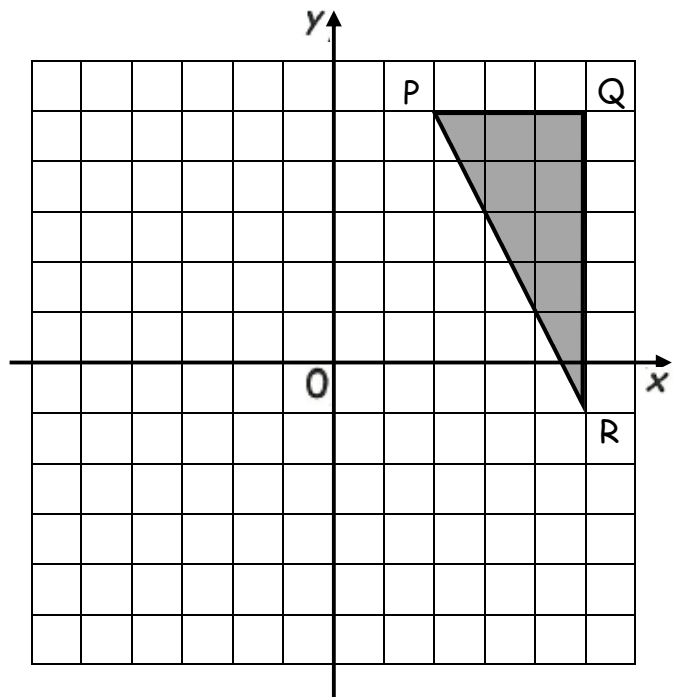
2. Write down the image of each point below after rotation by a quarter turn anti-clockwise about O:-

(a) Point K (3, 4)   (b) Point L (-3, 4)   (c) Point M (-3, -4)

(d) Point N (3, -4)   (e) Point P (x, y)

3. Write down the images of points K, L, M, N and P in question 2 after rotation by a quarter turn **clockwise**.

Exercise 3

1. Describe the translation made by the fighter plane accurate to the nearest millimetre:-
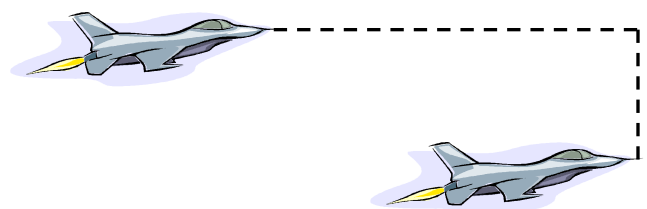
2. (a) Copy the axes and hexagon on to square paper.

    (b) On the same diagram, draw the image of the hexagon after a translation of:-

        (i)   4 right and 2 down
        (ii)   4 right and 2 up
        (iii) 4 down
        (iv)   4 up

    (c) State the coordinates of the image of vertex A after each translation in (b).

    (d) Describe **two** more translations which, when the images are drawn, would complete a **ring** of hexagons around the original.
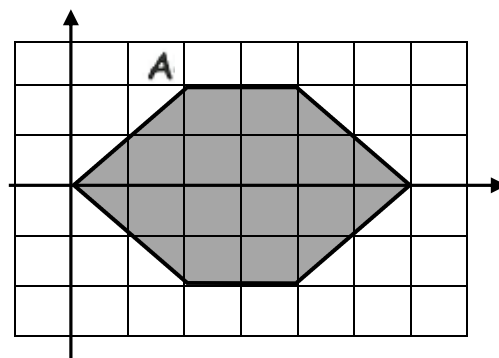
MNU 4-19a: Having investigated patterns in the environment, I can use appropriate mathematical vocabulary to discuss the rotational properties of shapes, pictures and patterns and can apply my understanding when completing or creating designs.

Exercise 1

1. Which of the following shapes have half-turn symmetry ?

    (a)   (b)   (c)   (d)   (e)   (f)
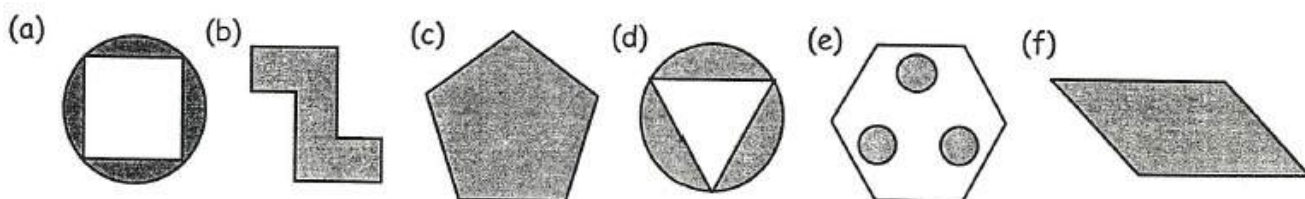
2. Seven capital letters of the alphabet have $\frac{1}{2}$-turn symmetry.
    Which letters ?

3. State what kind of turn symmetry each of the following shapes have. ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$), and state the "order" of rotational symmetry in each case.

    (a)   (b)   (c)   (d)

    (e)   (f)   (g)   (h)
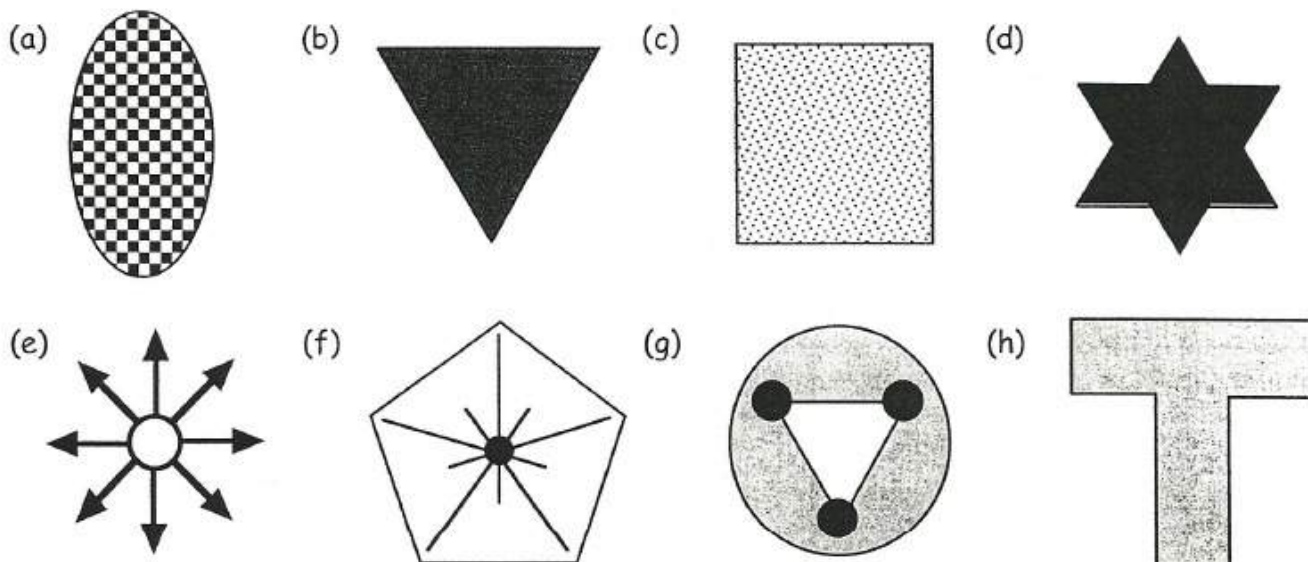
Exercise 2

1. Copy each of these shapes and rotate each one by 180°, ($\frac{1}{2}$ a turn), around the dot.

(a)

(b)

(c)

(d)

(e)

(f)
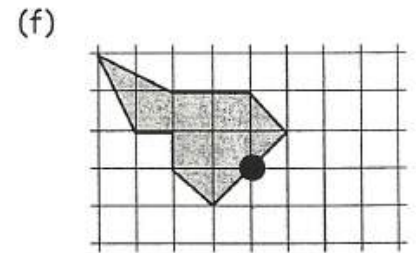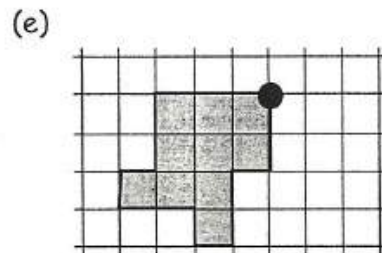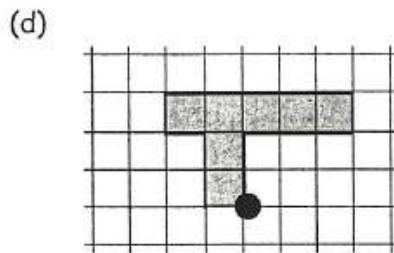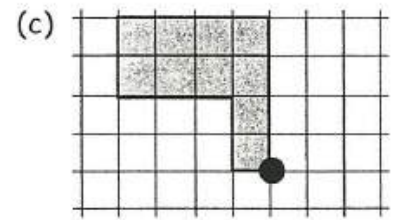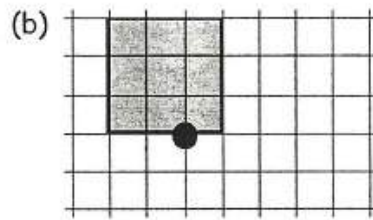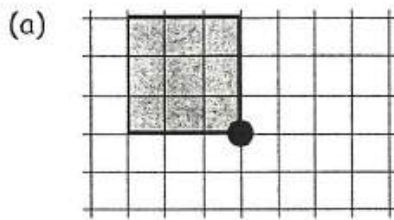
2. (Tricky!) Copy this shape.

    Try to rotate the shape by 90° (a $\frac{1}{4}$ turn)
    clockwise about the dot.
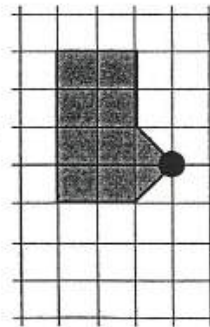
MNU 4-20a: I can evaluate and interpret raw and graphical data using a variety of methods, comment on relationships I observe within the data and communicate my findings to others.

Exercise 1

1. The stem and leaf diagram shows the ages of spectators watching a football match.

    (a) Write a key for the diagram.

    (b) Write out all the ages shown in the diagram.

    (c) How old was the youngest spectator?

    (d) What was the modal age?

    (e) Find the median.

Spectators ages

1	2 2 6 9
2	0 4 5 6
3	0 1 1 1 2 4
4	2
5	0 3

2. For each set of data shown :–

    (i) Construct an ordered stem and leaf diagram.   (ii) Find the mode and median.

(a) Ages of mature students at a University.

23	42	27	37	25	60	29	35	26	45	35	26
50	39	27	26	42	47	26	59	42	23	29	29
20	51	43	44	28	46	42	27	52	30	30	42

(b) Distances (in metres) jumped from a standing position.

1·62	1·23	1·41	1·15	0·97	1·31	1·23	1·26	1·5
1·33	1·29	1·12	1·23	1·19	1·36	1·53	1·08	1·23
0·9	1·2	1·51	1·03	1·66	1·53	1·44	1·23	1·39

Exercise 2

1. A class was asked to complete a survey. For each set of data below:-

    (i)   Draw a dotplot
    (ii) Comment on the distribution

    (a)   Weight (in kg):-
    34, 67, 38, 61, 66, 40, 40, 56, 51, 60, 67, 48, 62, 41, 59, 68, 37, 67, 39

    (b)   Height (in cm):-

    166, 159, 179, 171, 177, 164, 156, 170, 175, 162, 166, 161, 179, 163

    (c)   Shoe size:-

    9, 4, 10, 5, 7, 7, 5, 11, 5, 4, 8, 6, 5, 8

Exercise 3

1. The table shows the results of a questionnaire asking a group of 90 pupils their favourite bedtime drink.

(a) COPY and complete the table.

(b) Construct an accurate pie chart using a pair of compasses, a protractor and the table information.

Drink	Number	Fraction	Angle
Water	10	$\frac{10}{90}$	$\frac{10}{90} \times 360 = 40°$
Chocolate	15	$\frac{15}{90}$	$\frac{15}{90} \times 360 = \ldots°$
Milk	30	$\frac{\ldots}{90}$	$\frac{\ldots}{90} \times 360 = \ldots°$
None	35	$\frac{\ldots}{90}$	$\frac{\ldots}{90} \times 360 = \ldots°$
TOTAL	90	1	360°

2. For each table below, construct an accurate pie chart, showing all your working.

(a)

Favourite pet	Number
Cat	20
Dog	10
Mouse	12
Rabbit	18
TOTAL	....

(b)

People's weight (kg)	Number
30 - 50	80
51 - 70	120
71 - 90	480
91 - 110	40
TOTAL	....

MNU 4-20b: In order to compare numerical information in real-life contexts, I can find the mean, median, mode and range of sets of numbers, decide which type of average is most appropriate to use and discuss how using an alternative type of average could be misleading.

Exercise 1

1. Calculate the **mean** for each set of data :-

   (a) 3, 8, 4, 2, 10, 7, 8

   (b) 50, 60, 52, 58, 54, 56

   (c) 1·3, 2·6, 3·2, 4·1, 5, 4·8, 4, 1·9, 0·1, 2

   (d) the first ten prime numbers.

2. Find the **median** for each set of data :-

   (a) 1, 3, 5, 6, 8, 11, 14

   (b) 16, 22, 23, 25, 31, 40, 61, 63

   (c) 4, 1, 14, 12, 6, 7, 11, 13, 9

   (d) 5, 8, 21, 12, 5, 16, 33, 12, 15, 9.

3. Find the **mode** for each set of data :-

   (a) 1, 1, 2, 3, 5, 8, 13, 21, 34, 55

   (b) 3, 2, 1, 8, 4, 5, 9, 2, 7, 6, 0,

   (c) 1·7, 2·3, 1·6, 3, 2·3, 3·7, 2·9,

   (d) A, C, F, G, H, Y, T, E, D, D, G, H, G.

4. Find the **mean, median, mode** and **range** of each set of data :-

   (a) 10, 14, 15, 15, 16, 19, 22, 23, 27, 29, 30

   (b) 46, 31, 66, 73, 83, 43, 16, 66

   (c) All the prime numbers between 30 and 50.

5. The mean cost for 12 people to hire a bus was to be £15.

   Unfortunately, some people did not turn up for the bus trip.

   Each of those who went on the trip ended up paying £22·50.

   How many must have turned up ?

Exercise 2

1. For each data set below: (i)   find the mean, median and mode
                                 (ii)   state which average best describes the data

    (a)   12, 10, 69, 10, 100, 44, 45, 10, 32

    (b)   273, 222, 296, 124, 131, 118, 240, 141, 120, 135

    (c)   12, 8, 15, 8, 11, 10, 5, 13, 17

2. A factory owner claims that his business pays wages which are higher than the
    national average of £22000 per year.

    A spokesperson for the factory's workers says that the owner pays **less** than the
    national average.

    The factory employs nine people who earn the following per year:-

    £16000, £16000, £18500, £19000, £21000, £21000, £22500, £26000, £29000

    The factory owner pays himself £75000 per year.

    (a)   Show that, depending on the type of average used, the factory owner and the
          workers' spokesperson are **both** correct.

    (b)   Which person is being more honest?

> **MNU 4-21a: I can select appropriately from a wide range of tables, charts, diagrams and
> graphs when displaying discrete, continuous or grouped data, clearly
> communicating the significant features of the data.**

Exercise 1

1. The data below shows the number of cars parked
    on a main street each day at lunchtime.

16	11	32	40	65	32	33	18	12	6	23
57	16	54	42	67	32	78	47	49	52	70
16	38	7	13	35	79	71	52	24	15	10

Class Intervals	Tally	Frequency
0 - 9		
10 - 19	COPY	
20 - 29		
30 - 39		
40 -		

    (a) COPY and complete the frequency table.

    (b) On how many days was data collected ?

    (c) On how many days were there more than 30 cars
        parked at lunchtime ?

2. For each set of data below, choose a suitable class interval and construct a frequency table.

(a)

13	4	41	69	51	58	57	33
11	40	46	61	22	22	52	63
14	53	46	54	42	56	60	54
50	29	43	13	46	17	25	21
25	36	39	20	7	11	14	6

(b)

20	18	5	18	13	9	11	21
7	17	8	22	13	23	4	19
6	15	13	26	10	19	17	22
14	26	10	8	18	19	24	3
11	11	15	23	8	26	17	5

Exercice 2

1. A footballer practised taking 4 penalties every day. The table shows the results over several weeks.

   (a) COPY and complete the table.

   (b) How many days did he record taking penalties ?

   (c) How many penalties were scored in total ?

   (d) Calculate the mean number of penalties scored.

No. scored (x)	Freq (f)	f × x
0	2	0 × 2 = 0
1	2	1 × 2 = ...
2	11	2 × .. = ...
3	16	.. × .. = ...
4	9	.. × .. = ...
...		...

2. Shown are the test scores for classes 2X1 and 2Y1.

2X1 scores (x)	Freq (f)
12	1
14	6
16	8
18	9
20	6

2Y1 scores (x)	Freq (f)
12	5
14	5
16	11
18	8
20	1
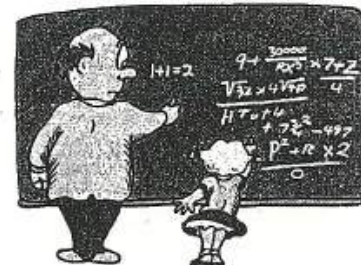
Find the mean score for each class.

Exercice 3

1. A gardener recorded the number of new dandelions that appeared in his lawn each week over a 7 week period.

   He began to use a weed killer and studied the results.

   (a) Copy and complete the table.

   (b) Which week did the gardener start using the weedkiller ?

   (c) Find the median.

Week	Frequency (new weeds)	Cumulative freq. (total so far)
1	3	3
2	12	15
3	36	...
4	68	...
5	40	...
6	12	...
7	1	...

2. For each table below :-

(i) add a cumulative frequency column   (ii) find the median.

(a)

Goals	Frequency
0	1
1	4
2	12
3	11
4	8
5	6
6	0

(b)

Score	Frequency
0	2
1	3
2	5
3	15
4	18
5	6
6	2

(c)

No.	Frequency
10	3
11	3
12	12
13	16
14	15
15	24
16	35

Exercise 4

1.   Shown below is a box plot indicating the test scores (out of 25) for an S2 class:-
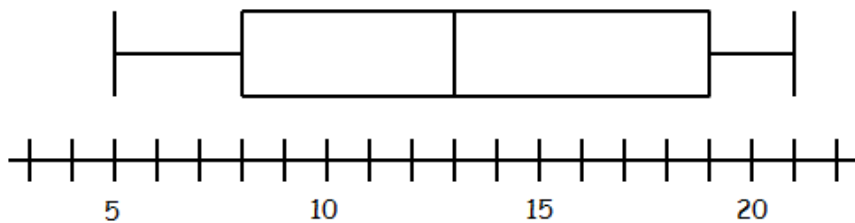
(a)   What was the   (i)   lowest score   (ii)   highest score   (iii) range?

(b)   Find:-   (i) Q_2 (ii) Q_1 and Q_3

(c)   Calculate the SIQR.

2.   For each data set below: (i)   write a five-figure summary
                                 (ii)   draw a box plot
                                 (iii)   calculate the **range** and **semi-interquartile range**

(a)   3, 4, 4, 5, 5, 5, 6, 8, 8, 9, 10, 10, 12, 13, 13

(b)   1, 2, 4, 5, 8, 14, 11, 4, 2, 1, 7, 11, 4, 7

(c)   1318, 1318, 1320, 1311, 1320, 1321, 1314, 1314, 1315, 1317

3.   Draw a box plot representing the set of data below (organise the data using a stem and leaf diagram first):-

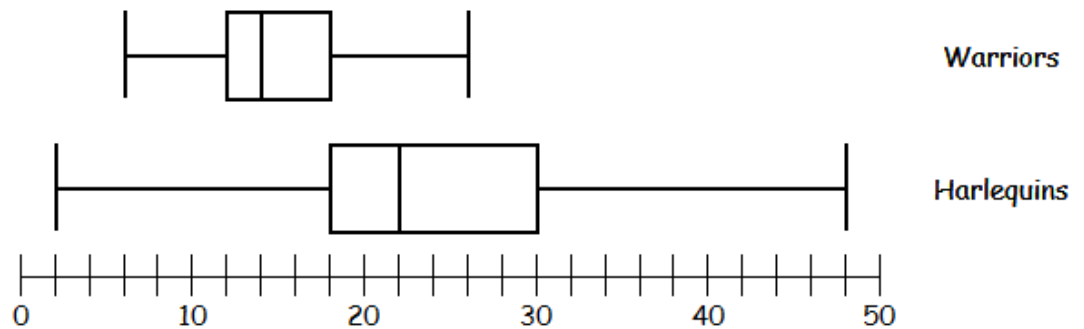35   22   47   20   27   29   38   45   49   12   46   44   8   10   42
32   17   8   23   31   22   36   25   40   33   22   41   25   6   43
43   8   5   16   6   17   10   42   6   9   33   15   34   37   12

4.   State the position of Q_1, Q_2, and Q_3 in a list of:-

(a)   15 numbers   (b)   25 numbers   (c)   21 numbers   (d)   42 numbers

5. The box plots show the number of points scored by two rugby teams during a season.

Warriors

Harlequins

(a) Make a five figure summary for each team

(b) Which team finished higher in the league table at the end of the season? Give **two** reasons for your answer.

> **MNU 4-22a:** By applying my understanding of probability, I can determine how many times I expect an event to occur, and use this information to make predictions, risk assessment, informed choices and decisions.

Exercise 1

1. A normal six-sided die is rolled 3000 times.

How many times would you **expect** the result to be:-

(a) a six

(b) an odd number

(c) greater than 4?
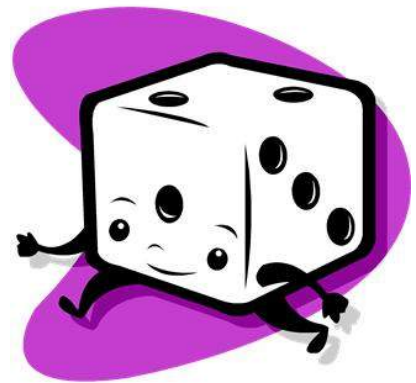
2. A survey asked 100 out of the 45000 voters in an election which party they would vote for.
The results are shown in the table.

Party	Votes
Labour	24
SNP	30
Lib Dem	4
Conservative	7
Green	10
Don't Know	25

(a) **How many** voters are likely to be undecided?

(b) How many more votes is the SNP candidate likely to get compared to her nearest rival?

(c) Candidates have to pay a deposit of £500 to stand in an election, and lose this money if they get less than 5% of the vote.
How many of the "Don't Know"s will have to vote Lib Dem if they want to avoid losing their deposit?

(d) The Labour party candidate thinks that if he gets 10000 of the "Don't Know"s to vote for him, he will win. Is he correct? Explain your answer.