MATHEMATICS

Unit 1

Expressions and Formulae

(Part 1 of 2)

Simplifying & Breaking Brackets

Exercise 1

Simplify the following

1) $3a + 4a + 5a$

2) $4b + 3b + 2b$

3) $5c + 2c + c$

4) $d + 3d + 7d$

5) $6e + 3e - 7e$

6) $3f + 8f + (-9f)$

7) $4x + 5x - 7x$

8) $8y - 3y - y$

9) $7z + 8z - 9z - 5z$

10) $3x - x + 4x - x$

11) $7y + y - 5y - y$

12) $z + 6z + 2z - 9z$

13) $2a + 4b + 5a + 2b$

14) $6x + 3y + 3x + 4y$

15) $8m + 6n - 2m + 3n$

16) $8a + 3b + a - b$

17) $5x + 4y - 2x - y$

18) $6p + q - 5p + 2q$

19) $7y + 2z - 6y + z$

20) $s + 7t + 4s - 3t$

21) $8x - 4x + y + 6y - 4x - 7y$

22) $5a + 2b - b + 3a - b - 8a$

23) $7m + n - 2m - 4m + 3n$

24) $y + 2z - y + 3z + 2y$

25) $3e + 2f - e + g - 2f - g$

26) $a + b + c - a + 2b - c$

27) $7x + 3y + z - 2x - y - z$

28) $3a + b + 2a + c - b + 2c$

29) $a + b + a - b + c - a$

30) $2m + n + p - 2m + 3n$

31) $s + 4t + u - 3s - 4t - u$

32) $p + q - p - q + 4r$

33) $3x + 2y + 5z - 3x + 6y$

34) $7a + b + 8c - 4a + 9b + 7c$

35) $8e + f + 6g - 5g + 2f + 3e$

36) $9s + 7t + u - 7t - u - 9s$

Exercise 2

Remove the brackets and simplify as far as possible.

1) $2(3x + 4)$

2) $4(2x + 3)$

3) $5(4x – 3)$

4) $4(5 + y)$

5) $2(5 + 3y)$

6) $4(2 – y)$

7) $6(2m + n)$

8) $2(p – 4q)$

9) $3(b – 5a)$

10) $2(y + 2z)$

11) $2(3r – 2s)$

12) $3(2p – 3q)$

13) $3(7s + u)$

14) $4(2a – 3b)$

15) $2(6n – 15m)$

16) $2(t – 2s)$

17) $5(y – x)$

18) $3(5f – 2e)$

19) $6(m + 2n)$

20) $8(3m + 5k)$

21) $5(a + 7b)$

22) $3(q – 4p)$

23) $4(2b –5c)$

24) $2(4z – 10y)$

Exercise 3

Remove the brackets and simplify as far as possible.

1) $2(3x + 4) + 3$

2) $2(3x + 4) –5$

3) $5(4 + 3y) + 3$

4) $4(5x – 3) –1$

5) $2(x + 3y) + 5x$

6) $4(2x + y) + 2y$

7) $6(2m + 2) – 3m$

8) $5(1 + 2q) + 2q$

9) $3(b – 5) – 7b$

10) $2(y + 2z) + 4y$

11) $2(3r + 2s) – 6r$

12) $5(p + 2q) – 4q$

13) $3(7s + u) +5u$

14) $5(b – a) – 2a$

15) $6(5m + 2n) –12m +2n$

16) $4s + 3t + 2(t – 2s)$

17) $8x + 4y + 5(y - x)$

18) $6e + 2f + 3(5f - 2e)$

19) $6(m + 2n) - 12n - 6m$

20) $8(3m + 5k) - 14m + 2k$

21) $5(a + 7b) - 35b + 5a$

22) $2(6p + 3q) + 3q - 4$

23) $3(2a + 3b) + 5a - 10b$

24) $4(3x + 5y) - 4x - 4y$

25) $3 - 5(3x + 4)$

26) $4 - 5(2y + 3)$

27) $3x - 2(2x + 4)$

28) $10 + 3(2x - 1)$

29) $2y + 3(3y - 4)$

30) $10 - 5(2a + 3b) + 12$

Factorising

Exercise 1

Factorise the following

1) $2x + 8$

2) $3y - 12$

3) $4p - 8$

4) $5z - 10$

5) $12 - 3x$

6) $8 - 2y$

7) $20 - 5x$

8) $15 - 3t$

9) $9x + 15$

10) $30 - 10x$

11) $6x + 12$

12) $15 + 3q$

13) $14x - 7$

14) $11 - 22x$

15) $4r - 16$

16) $20 - 12a$

17) $24x + 8$

18) $5a - 15$

19) $6t + 18$

20) $3w - 21$

21) $3x + 12$

22) $4 + 20a$

23) $7 - 14b$

24) $16a - 4$

25) $8b + 16$

26) $4x + 6$

27) $12a - 8$

28) $14p - 21$

29) $6r + 15$

30) $24 - 20q$

31) $16 + 12r$

32) $33a + 9$

33) $36b - 24$

34) $20q - 12$

35) $40 - 30w$

36) $18r + 12$

37) $16 + 20b$

38) $25a - 15$

39) $35p - 25$

40) 32y – 12 **41)** 6x + 3y **42)** 8a – 12b

43) 2x – 4y **44)** 14a – 7b **45)** 20d – 10e

46) 3a + 6b **47)** 5x – 15y **48)** 5w – 10x

49) 12a – 3b **50)** 8w – 2y **51)** 4t – 16u

52) 11x + 22y **53)** 14d – 7e **54)** 15w – 3x

55) 6x + 12y **56)** 12r – 18t **57)** 6x + 9y

58) 15e – 12f **59)** 24g + 16h **60)** 10w – 25x

61) 30r – 20t **62)** 12a – 16b **63)** 18c – 24d

64) 30d + 36e **65)** 28p – 21q **66)** ab – 2a

67) 3pq – p **68)** 8ab + 3b **69)** ac + c

70) xy + 3x **71)** 5ab – 7b **72)** 4mn + 3n

73) 2q – 3pq **74)** 6x + 13xy **75)** 5ab + 7a

Exercise 2

Factorise the following.

1) 3a + 12ab **2)** 3y – 15xy **3)** 4p – 8pq

4) 5z – 20xy **5)** 12xy – 3x **6)** 7ab + 14b

7) 6xy – 9y **8)** 12pq + 15q **9)** 4ef –8f

10) 5xy + 15y **11)** 3ef + 18f **12)** 21q – 7pq

13) 30r + 3rs **14)** 24x – 36xy **15)** 18a + 21ab

16) 5ab + 10ac **17)** 3ab – 6bc **18)** 4rs + 12st

19) 15ef – 20de **20)** 7pq – 14pr **21)** 8ct – 12cu

22) 12gh + 15hk **23)** 20pq – 8pr **24)** cd – ce

25) 4ab + bc **26)** 5xz + 30yz **27)** 18cd – 12de

28) 6ef + 2fg **29)** jk – 3kr **30)** 3xy – 18xz

Evaluation of Formulae

Exercise 1

Find the value of the following expressions when **x = 4, y = 2 and z = 3**.

1) 2x + y	**2)** 3y + 2z	**3)** 5x + z
4) x + 3z	**5)** x + y + z	**6)** x + 3y + 2z
7) 5x – 3y	**8)** 6y – 2z	**9)** 3x – 6y
10) 6x – 8z	**11)** x + y – z	**12)** x + 3y – 2z
13) 2x + 5y – 4z	**14)** 3x – y – z	**15)** 4y + z – 2x
16) y + z – x	**17)** 4x + y –6z	**18)** 5z – 5y – x
19) z – y + x	**20)** 8z – 4y – 2x	**21)** 2x + 3y – 4z

Exercise 2

Find the value when **a = 3 , b = 2 and c = 5**.

1) 2ac	**2)** 3bc	**3)** 4ab
4) abc	**5)** 3abc	**6)** 3ab + 2bc
7) 4bc + 2ab	**8)** 2ab – bc	**9)** 4ac – 2bc
10) 3ab + ac	**11)** 4a + bc	**12)** 5b – 3a
13) 5a – 3c	**14)** 3ab + 4bc	**15)** 6bc – 3ab
16) 3ac + b	**17)** a + 5ac	**18)** abc – 6b

Find the value when **x = 1 , y = 3 and z = 4**.

19) 4xy	**20)** 2yz	**21)** 5xz
22) xyz	**23)** 2xy + 3yz	**24)** 5xz + 4xy
25) 4yz – 8xy	**26)** 5xz – 2xy	**27)** 6x + 5y –2z
28) yz – 6x	**29)** 3xy + 2yz – 5xz	**30)** 6y + xyz

Find the value when **p = 2 , q = 1 and r = 3**.

31) 3p(2q + r) **32)** 5q(3p – r) **33)** 2r(p + 4q)

34) r(2p + 3q) **35)** 4q(4r – 3p) **36)** 3r(4p – 8q)

37) 2pr + 3q(p + r) **38)** 3qr + p(2q + r) **39)** 2r(p – q) +pq

40) 4q(3r – p) –2qr

Exercise 3

1) The cost (C pence) of framing a picture depends on its length (L cm) and its height (H cm). If $C = 3L + 2H$, find C when:

a) L = 50 , H = 20

b) L = 30 , H = 25

c) L = 80 , H = 50

2) The time, T minutes for a man to cycle U km uphill and D km downhill is given by $T = 12U + 2D$. Find T when:

a) U = 2 , D = 5

b) U = 6 , D = 8

c) U = 3 , D = 12

3) The number of potatoes (n) which I plant in spring depends on the area of my vegetable plot (A m^2) and the size of my lawn (L m^2).

If $n = 5A - 3L$ find n when:

a) A = 20 , L = 15

b) A = 100 , L = 50

c) A = 200 , L = 50

4) The time (T minutes) for a teacher to mark a pile of books depends on the number of pages (p) and the number of homeworks (h).

If $\boxed{T = 2p + 15h}$ find T when:

a) p = 6 , h = 2

b) p = 8 , h = 1

c) p = 10½ , h = 3

5) The cost (C pence) of hiring a taxi depends on the number n of kilometres you travel in it, where $\boxed{C = 70 + 5n}$. Find C when:

a) n = 2

b) n = 6

c) n = 20

6) The time taken (T minutes) to get to school depends on how far I walk (W km) and how far I go by bus (B km).

If $\boxed{T = 12W + 5B}$ find T when:

a) W = 4 , B = 8

b) W = 3 , B = 13

c) W = 2½ , B = 9

7) The number of cakes (n) which Mrs Hirst has to buy for her daughter's birthday party depends on the number of boys (B) and the number of girls (G), who are invited, where $\boxed{n = 4B + 3G}$. Find n if:

a) B = 12 , G = 5

b) B = 7 , G = 13

c) B = 11 , G = 14

8) The cost (C pence) of using my radio depends on how long I play it on batteries (b hours) and how long I use mains electricity (e hours).

If $\boxed{C = 2(3e + 2b)}$ find C when:

a) e = 30 , b = 6

b) e = 12 , b = 15

c) e = 15 , b = 12

9) My uncle earns £ E when he puts new soles on S shoes and new heels on H shoes where $\boxed{E = 2(4S + 2H)}$. Find E when:

a) S = 5 , H = 2

b) S = 10 , H = 5

c) S = 8 , H = 7

10) A bus driver will collect P pence if the bus has A adults and C children travelling on it between two stops on both the outward and return journey.

If $\boxed{P = 2(25A + 15C)}$ find P when:

a) A = 4 , C = 6

b) A = 10 , C = 3

c) A = 12 , C = 8

11) I put T tulip bulbs and D daffodil bulbs into B bags and sell them on the market. My income £ I is given by the formula $\boxed{I = B(12T + 7D)}$.
Find I when:

a) B = 2 , T = 3 , D = 4

b) B = 5 , T = 5 , D = 3

c) B = 10 , T = 6 , D = 5

12) On my holiday of D days , I cycle for C hours and walk for W hours. The distance in miles (M) which I travel is given by the formula $\boxed{I = D(12C + 2W)}$. Find M when:

a) D = 4 , C = 5 , W = 2

b) D = 8 , C = 4 , W = 3

c) D = 12 , C = 3 , W = 4

13) When two resistors of strengths P and Q are connected in parallel in an electrical circuit, their total effect R is given by the formula $\boxed{R = \frac{PQ}{P+Q}}$. Find R when:

a) P = 5 , Q = 5

b) P = 7 , Q = 3

c) P = 9 , Q = 3

14) The height H of water in a tank depends on the rate R at which it is flowing in, the area of the cross–section A of the tank and time T after the water starts to flow.

If $\boxed{H = \frac{RT}{2A}}$ find H when:

a) R = 3 , T = 20 , A = 5

b) R = 9 , T = 8 , A = 3

c) R = 12 , T = 7 , A = 4

Exercise 4

Find the value of **x** if **a = 4 , b = 3 and c = 2**

1) $x = a + b + c$ **2)** $x = 2a + c$ **3)** $x = a + 3b$

4) $x = 5a - b$ **5)** $x = 3a + b - 4c$ **6)** $x = 3(a - c)$

7) $x = 4(a - b)$ **8)** $x = 5(6a - 3b)$ **9)** $x = ab + c$

10) $x = ab - c$ **11)** $x = ab + ac$ **12)** $x = 5(bc + a)$

13) $x = 2(ab - c)$ **14)** $x = a(b + c)$ **15)** $x = b(2a - c)$

Exercise 5

If **p = 6 , q = 4 and r = 1** find the value of **y**.

1) $y = 2p - q$ **2)** $y = q - 4r$ **3)** $y = p - 2q$

4) $y = r - p$ **5)** $y = q + 2r - p$ **6)** $y = 2(q + r)$

7) $y = 3(r - q)$ **8)** $y = q(p + 2r)$ **9)** $y = p^2 + q$

10) $y = p^2 + q^2$ **11)** $y = (p + q)^2$ **12)** $y = 2q^2$

13) $y = (2q)^2$ **14)** $y = 3r^2$ **15)** $y = (3r)^2$

Exercise 6

If **x = 8 , y = 2 and z =3** find the value of **m** in each of these.

1) $m = x - y - z$ **2)** $m = xy - z$ **3)** $m = xyz$

4) $m = z - x$ **5)** $m = y - x$ **6)** $m = y^2 + z^2$

7) $m = y^2 - z^2$ **8)** $m = 3y^2 + 2z^2$ **9)** $m = (3y)^2 + (2z)^2$

10) $m = 5(x + z)$ **11)** $m = y(x - z)$ **12)** $x(y^2 - z)$

Number Patterns and Sequences

Exercise 1

Copy these sequences into your jotter and write down the next 2 numbers

1) 32, 34, 36, 38, …., ….**2)** 16, 19, 22, 25, …., …. **3)** 17, 20, 23, 26, …., ….

4) 39, 36, 33, 30, …., ….**5)** 51, 48, 45, 42, …., …. **6)** 21, 25, 29, 33, …., ….

7) 52, 56, 60, 64, …., ….**8)** 4, 5, 6, 7, …., …. **9)** 9, 10, 11, 12, …., ….

10) 4, 6, 8, 10, …., …. **11)** 6, 9, 12, 15, …., …. **12)** 10, 15, 20, 25, …., ….

13) 19, 26, 33, 40, 47, …., …. **14)** 73, 62, 51, 40, 29, …., ….

15) 19, 30, 41, 52, 63, …., …. **16)** 49, 41, 33, 25, 17, …., ….

17) $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, …., …. **18)** 8, $7\frac{1}{2}$, 7, $6\frac{1}{2}$, 6, …., ….

19) 0·2, 0·9, 1·6, 2·3, 3·0, …., …. **20)** 7·6, 6·5, 5·4, 4·3, 3·2, …., ….

21) 13, 26, 39, 52, 65, …., …. **22)** 95, 80, 65, 50, 35, …., ….

23) $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$ …., …. **24)** $\frac{1}{2}$, 2, $3\frac{1}{2}$, 5, $6\frac{1}{2}$, …., ….

25) 1, 3, 6, 10, 15, …., …. **26)** 1, 4, 9, 16, 25, …., ….

27) 2, 4, 8, 14, 22, …., …. **28)** 1, 4, 10, 19, 31, …., ….

29) 4, 7, 12, 19, 28, …., …. **30)** 0, 5, 15, 30, 50, …., ….

31) 0, 4, 12, 24, 40, …., …. **32)** 22, 17, 13, 10, 8, …., ….

33) 41, 30, 21, 14, 9, …., …. **34)** 18, 25, 31, 36, 40, …., ….

35) 1, 2, 4, 8, 16, …., …. **36)** 1, 3, 9, 27, 81, …., ….

37) 3, 6, 12, 24, 48, …., …. **38)** 320, 160, 80, 40, 20, …., ….

39) 224, 112, 56, 28, 14, …., …. **40)** 15625, 3125, 625, 125, 25, …., ….

41) 1, 4, 11, 22, 37, …., …. **42)** 100, 87, 76, 67, 60, …., ….

43) 1, 9, 24, 46, 75, …., …. **44)** 2, 3, 5, 8, 13, 21, …., ….

45) 1, 5, 6, 11, 17, 28, …., ….

46) 99, 61, 38, 23, 15, 8, …., ….

47) 1, 4, 16, 64, …., ….

48) 1, 10, 100, 1000, …., ….

49) 32, 16, 8, 4, 2, …., ….

50) 162, 54, 18, 6, …., ….

51) 1, 2, 6, 24, 120,…., ….

52) 1, 4, 3, 6, 5, 8, …., ….

53) 2, 1, 6, 4, 10, 7, …., ….

54) 1, 5, 4, 10, 9, 15, …., ….

55) 1, $1\frac{1}{2}$, $2\frac{1}{2}$, 4, 6, $8\frac{1}{2}$, …., ….

56) 1, 1, 1, 3, 5, 9, 17, …., ….

57) 1, 2, 6, 15, 31, …., ….

58) 22, 16, 11, 7, 4, 2, …., ….

Exercise 2

For each question:

a Copy and complete the table

b Write down the **formula** which works for the table

1

A	1	2	3	4	5	6		30
B	5	8	11					

2

C	1	2	3	4	5	6		25
D	6	8	10					

3

E	1	2	3	4	5	6		50
F	1	3	5					

4

G	1	2	3	4	5	6		100
H	1	4	7					

5

J	1	2	3	4	5	6		60
K	4	7	10					

6

L	1	2	3	4	5	6		25
M	5	9	13					

7

N	1	2	3	4	5	6		30
P	4	9	14					

8

Q	1	2	3	4	5	6		40
R	1	5	9					

9

S	1	2	3	4	5	6		35
T	7	9	11					

10

U	1	2	3	4	5	6		40
V	7	12	17					

11

D	1	2	3	4	5		36	
A	1	3	5					81

12

T	1	2	3	4	5		27	
K	7	10	13					100

13

P	1	2	3	4	5		18	
F	1	5	9					97

14

Z	1	2	3	4	5		37	
S	8	11	14					158

15

C	1	2	3	4	5		200	
L	10	12	14					200

16

G	1	2	3	4	5		43	
X	9	13	17					77

17

R	1	2	3	4	5		18	
M	1	6	11					121

18

U	1	2	3	4	5		22	
B	7	13	19					211

19

Q	1	2	3	4	5		41	
V	8	13	18					303

20

E	1	2	3	4	5		300	
Y	4	12	20					300

21

N	1	2	3	4	5		24	
M	1½	2	2½					16

22

P	1	2	3	4	5		30	
Q	0	½	1					30

23

A	2	4	6	8	10		49	
B	7	11	15					49

24

C	2	4	6	8	10		17	
D	5	11	17					101

25

E	3	6	9	12	15		36	
F	13	25	37					225

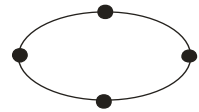
26

G	1	2	3	4	5		11	
H	2	5	10	17				401

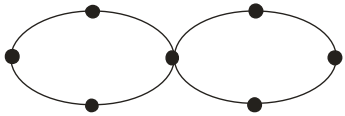
Exercise 3

1) A manufacturer makes necklaces in various sizes.

The smallest size has a single link which is made up of **1 ring and 4 beads.**



The next size looks like this:



a) Draw the next size in the sequence.

b) Complete this table to show how the pattern is built up.

Number of rings (R)	1	2	3	4	5		13
Number of beads (B)	4	7					

c) Write down a formula for finding the number of beads (B) if you know the number of rings (R).

2) The following patterns are made using circles.


Pattern 1


Pattern 2


Pattern 3

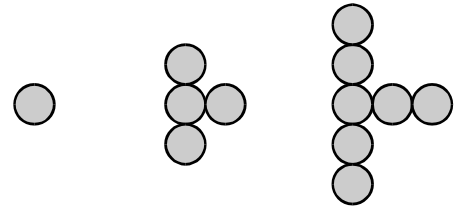
a) Draw Pattern 4

b) Complete this table showing how many circles are needed for each pattern.

Pattern Number (P)	1	2	3	4	5	6		12
Number of Circles (C)								

c) Write down a formula for finding the number of circles (C) if you know the pattern number (P).

3) These patterns are made with circles.



Pattern 1 Pattern 2 Pattern 3

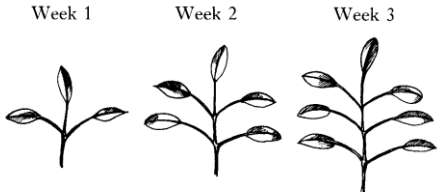
a) Draw pattern 4.

b) Complete the table.

Pattern number (P)	1	2	3	4	5	6		12
Number of circles (C)	1	4						

c) Write down a formula for finding the number of circles if you know the pattern number.

4) The growth of a plant over three weeks is shown in these sketches.



The plant continues to grow at the same rate.

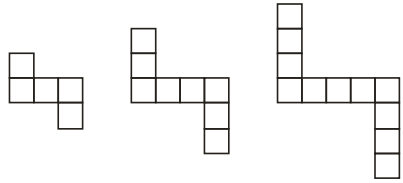
a) Draw a sketch to show what the plant will look like in week 4.

b) Complete the table to show the continued growth of the plant.

Week (W)	1	2	3	4	5	6		12
Number of leaves (L)	3	5						

c) Write down a formula for finding the number of leaves (L) on the plant if you know the number of weeks (W) it has been growing.

5) These patterns are made with squares.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

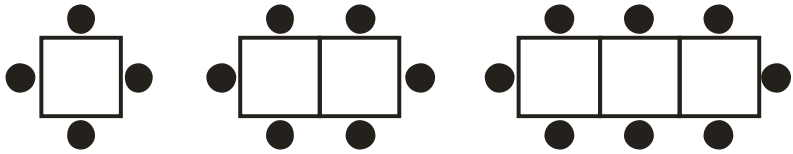
a) Draw Pattern 4 in the space above.

b) Complete this table.

Pattern number (P)	1	2	3	4	5	6		11
Number of squares (S)								

c) Write down a formula for finding the number of squares (S) if you know the pattern number (P).

6) The diagrams below show the number of people sitting at desks.



a) Draw the next diagram in the sequence

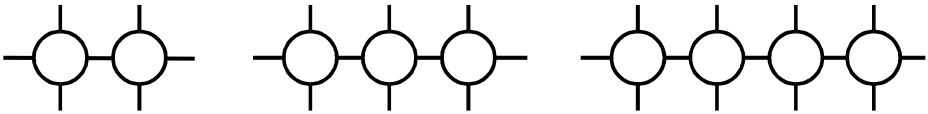
b) Complete the table below for this pattern.

Number of desks (D)	1	2	3	4		10		20
Number of people (P)								

c) Write down a formula for finding the number of people (P) if you know the number of desks (D).

7) John was doodling during his art lesson and stumbled upon an interesting pattern. He noticed that if he joined two circles by a straight line and then added other lines around the sides an ordered pattern was formed.

The first three doodles in his pattern are shown below.



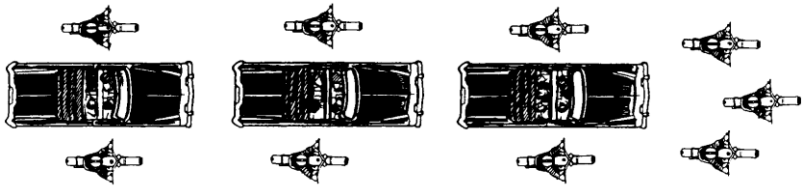
a) Draw the next doodle in John's pattern.

b) Complete the table below to show how many lines there would be around a particular number of circles.

Number of circles (C)	2	3	4	5	6	7	8		20
Number of lines (L)	7	10	13						

c) Write down a formula for finding the number of lines (L) if you were given the number of circles (C).

8) When a line of cars is given a police escort, it is led by three motorbikes and each car has a motorbike on either side.

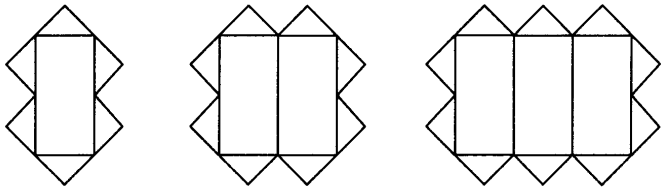


a) Complete the table.

Number of cars (C)	2	3	4	5	6		13
Number of motorbikes (M)		9					

b) Write down a formula for finding the number of motorbikes (M) if you know the number of cars (C).

9) A design consists of rectangles and triangles.



The first three patterns are shown.

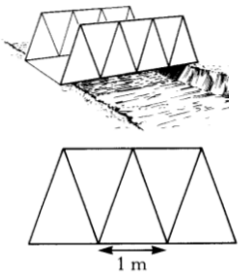
a) Complete this table

Number of rectangles (R)	1	2	3	4	5	6		9
Number of triangles (T)	6	8						

b) Write down a formula for finding the number of triangles (T) if you know the number of rectangles (R).

Exercise 4

1) The sides of bridges can be made by joining together identical triangular plates, each with a base length of 1 metre**.**



The diagram below shows one side of a bridge 3 metres long, which needs 5 plates.

a) Copy and complete the table below.

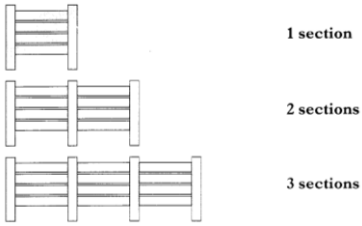
Length of bridge in metres (L)	3	4	5	6	7		20
Number of plates for one side (N)	5						

b) Write down a formula for the number of plates, N, needed to make one side of a bridge of length L metres.

c) Can one side of a bridge have exactly 90 plates?
Explain your answer.

2) A children's play area is to be fenced.

The fence is made in sections using lengths of wood as shown.



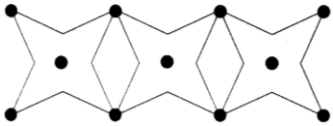
a) Copy and complete the table.

Number of sections (s)	1	2	3	4	5		12
Number of lengths of wood (w)	6	11					

b) Write down a formula for calculating the number of lengths of wood (w), when you know the number of sections (s).

3) Jenni is making a wallpaper border.

She is using stars and dots to make the border.



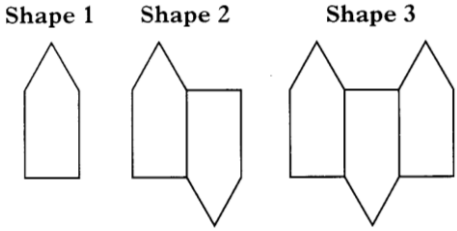
a) Copy and complete the table.

Number of stars (s)	1	2	3	4	5
Number of dots (d)			11		

b) Write down a formula for calculating the number of dots (d), when you know the number of stars (s).

4) Sandra is working on the design for a bracket.

She is using matches to make each shape.

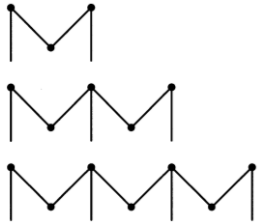


a) Copy and complete the table.

Shape number (s)	1	2	3	4	5	6		13
Number of matches (m)	5	9			21			

b Find a formula for calculating the number of matches, (m), when you know the shape number, (s).

5) Mhairi makes necklaces in M-shapes using silver bars.



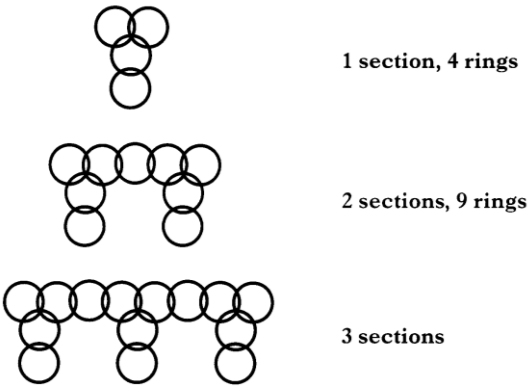
a) Copy and complete the table.

Number of M-shapes (m)	1	2	3	4		15
Number of bars (b)	4	7				

b) Write down a formula for calculating the number of bars (b) when you know the number of M-shapes (m).

6) Samira is designing a chain belt.

Each section of the belt is made from metal rings as shown.



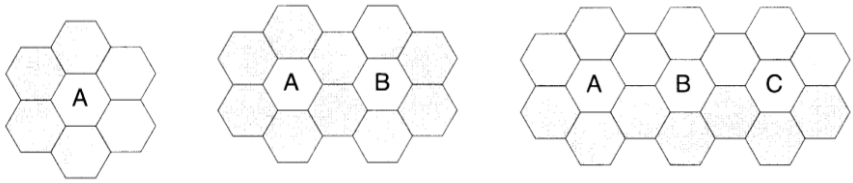
a) Copy and complete the table below.

Number of sections (s)	1	2	3	4	5		11
Number of metal rings (r)	4	9					

b) Write down a formula for calculating the number of rings (r) when you know the number of sections (s).

7) Carla is laying a path in a nursery school.

She is using a mixture of alphabet tiles and blank tiles.

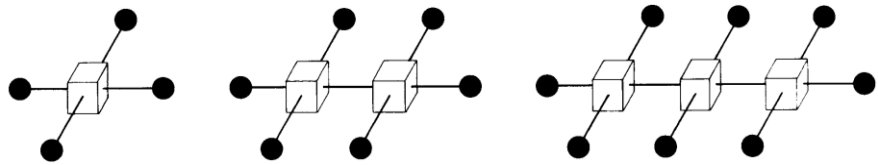


a) Copy and complete the table below

Number of alphabet tiles (a)	1	2	3	4	5		12
Number of blank tiles (b)	6	10					

b) Write down a formula for calculating the number of blank tiles (b) when you now the number of alphabet tiles (a).

8) A child is playing with a set of cubes and spheres and his mother notices that the shapes he is making form a pattern. The first three shapes are shown below.

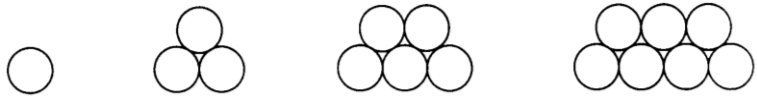


a) Copy and complete the table below.

Number of cubes (c)	1	2	3	4	5	6		20
Number of spheres (s)	4	6						

b) Write down a formula for calculating the number of spheres (s) when you know the number of cubes (c).

9) A pipe factory makes circular pipes. The storeman arranges the pipes in stacks which form a pattern. The stacks must not be higher than two layers. The first four stacks are shown below.



a) Copy and complete the table below.

Stack (s)	1	2	3	4	5	6		15
Number of pipes (p)	1	3	5					

b) Write down a formula for calculating the number of pipes (p) when you know the stack (s).

c) The storeman has to store 12 pipes. He finds that he has to use more than one stack from the pattern to do this.

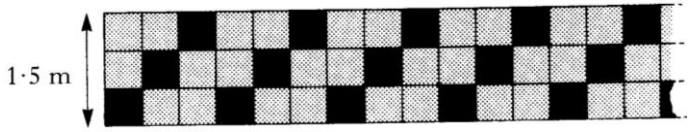
i) Why is it not possible to use only one stack from the pattern?

ii) Draw a possible set of stacks for the 12 pipes.

10) In a large office block, the corridor floors are covered with carpet tiles. The corridors are 1·5 metres wide.

The carpet tiles are half-metre squares and they come in two colours, grey and black.

The pattern in one of the corridors is shown below.



a) How many grey tiles are there in every metre length of corridor?

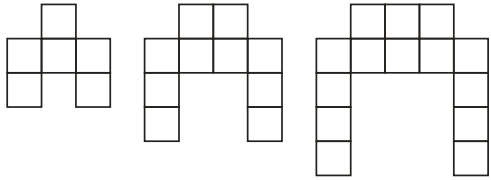
b) If there are G grey tiles in L metres of corridor, write down a formula for G.

c) Could this corridor have exactly 39 grey tiles?

Explain clearly your answer.

Exercise 5

1) Here is a sequence of patterns.



1st pattern 2nd pattern 3rd pattern

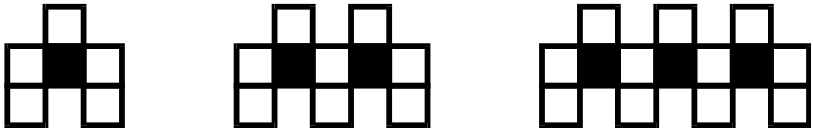
a) Copy and complete the table below.

Pattern number (n)	1	2	3	4	5		12
Number of squares (s)							

b) Write down the formula for the number of squares (s) in the n^{th} diagram.

c) Which pattern has 130 squares?

2) The diagrams below are the first three in a sequence.



Each diagram is made up of black and white squares.

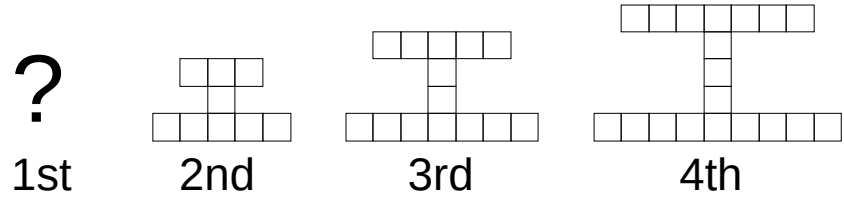
a) Following the pattern copy and complete the table.

Number of black squares (B)	1	2	3	4	5	6	■	12
Number of white squares (W)		8					■	

b) Write down the formula for the number of white squares, W, if there are B black squares.

c) How many black squares are there if there are 65 white squares?

3) The diagram below shows the 2nd, 3rd and 4th diagrams in a sequence.



a) Copy and complete the table below.

Diagram Number (n)	1	2	3	4	5	6	■	80
Number of squares (s)							■	

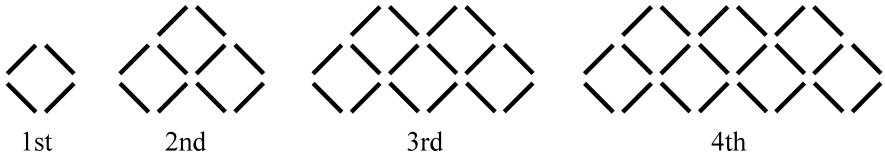
b) Draw the first diagram in the sequence.

c) Write down a formula for **s** in terms of **n**.

d) Which diagram has 94 squares?

4) A child is making a sequence of zigzag patterns using rods.

These are the first few diagrams in the sequence.



a) Copy and complete the table below.

Diagram Number (n)	1	2	3	4	5	6		12
Number of rods (r)	4	10						

b) How many rods are in the n^{th} diagram.
Write your answer as a formula.

c) Which diagram in the sequence has **400 rods**?

5) Easyloan Hire Company hires out tools and building equipment.

The cost (£C) of hiring a ladder for , d, days is shown in the table below.

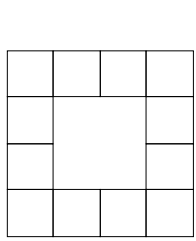
Number of days (d)	2	3	4	5
Cost in £s (C)	11	15	19	23

a) Write down a formula connecting C and d.

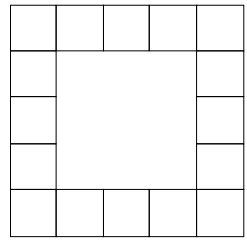
b) Use your formula to calculate the cost of hiring a ladder for a fortnight.

c) How many days is the ladder hired for if the cost is £111?

6) The first 2 patterns in a sequence of diagrams are shown below.



1st



2nd

?

3rd

The first diagram contains 12 **small** squares.

a) How many **small** squares are in the 3rd diagram?

b) Copy and complete the table below.

Diagram number (n)	1	2	3	4	5		10
Number of small squares (s)	12						

c) Write down the formula for **s** in terms of **n**.

d) Which diagram has 200 squares?

7) A child is making patterns of the letter **H** using square tiles.

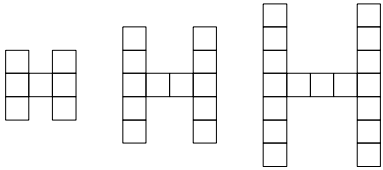


Diagram 1 Diagram 2 Diagram 3

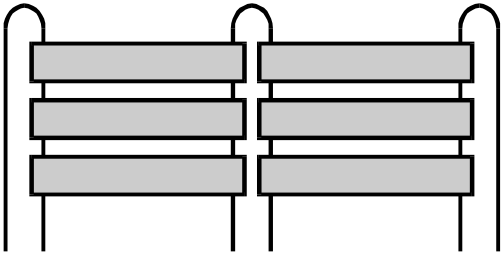
a) Copy and complete the table below.

Diagram number (n)	1	2	3	4	5		10
Number of tiles (t)	7						

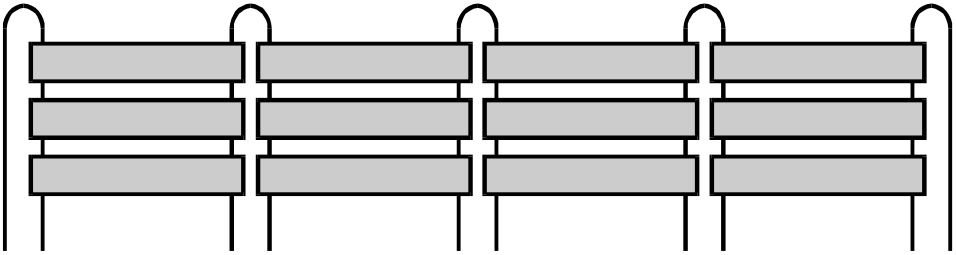
b) Write down the formula for **t** in terms of **n**.

c) Which diagram has 222 tiles?

8) A garden fence arrangement can be built in patterns as shown.



This fence pattern is made up with **3 fenceposts** and **6 panels**.



This fence pattern is made up with **5 fenceposts** and **12 panels**.

a) Copy and complete the table below.

Number of fenceposts (F)	2	3	4	5	6	7
Number of panels (P)		6				

b) Write down a formula connecting **P** and **F**.

c) A farmer buys **144 panels** and **52 fenceposts** to build a fence like those above.

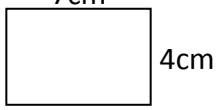
How many fenceposts are left over if all of the panels are used up?

Area

Exercise 1 (remember to include units in your answers – cm^2, m^2, km^2)

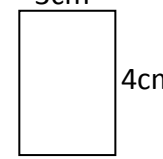
1) Work out the area of the following rectangles (no calculator)

a)



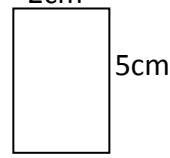
b)

c)

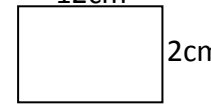


d)

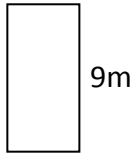
e)



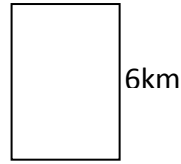
f)



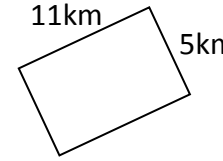
g)



h)

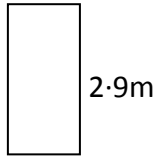


i)

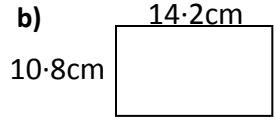


2) Work out the area of these rectangles (calculator)

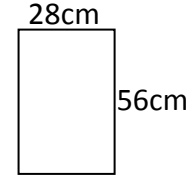
a)



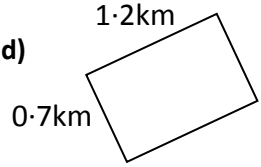
b)



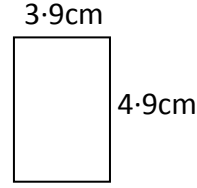
c)



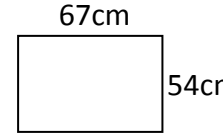
d)



e)



f)



Exercise 2 (remember to include units in your answer – cm^2, m^2, km^2)

Work out the area of the following squares and rectangles
(remember to include units in your answer)

1) 4cm by 8cm **2)** 9cm by 7cm **3)** 2·5m by 2·5m

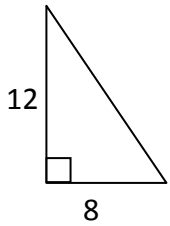
4) 3·6km by 5km **5)** 24cm by 16cm **6)** 1·25m by 1·25m

7) 100m by 3·2m **8)** 4·9m by 97·2cm **9)** 6mm by 7·2m

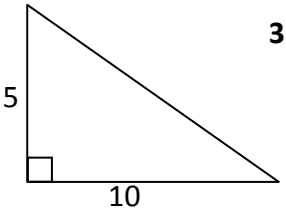
Exercise 3 (remember to include units in your answer: cm^2, m^2, km^2)

Using the rule **Area of Triangle =** $\frac{1}{2}$ **x base x height**, find the area of the following triangles (all lengths are in cm)

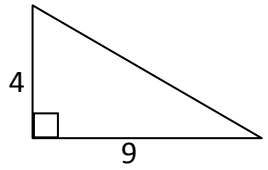
1)



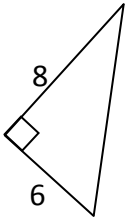
2)



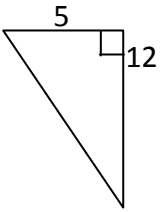
3)



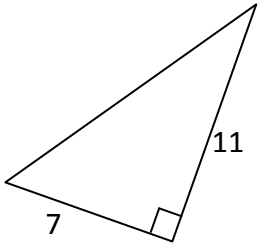
4)



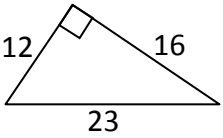
5)



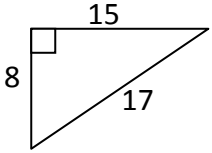
6)



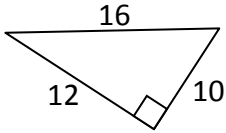
7)



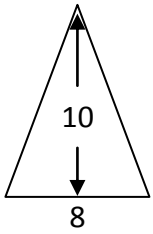
8)



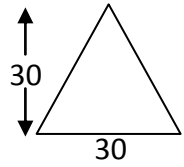
9)



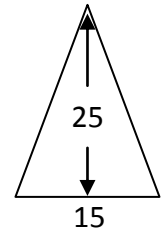
10)



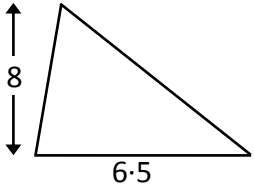
11)



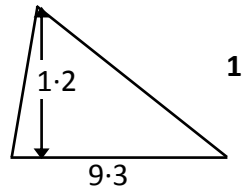
12)



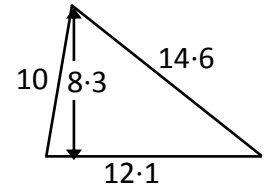
13)



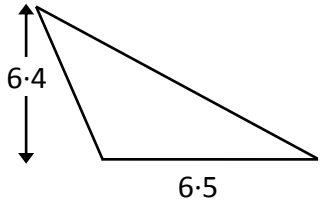
14)



15)



16)



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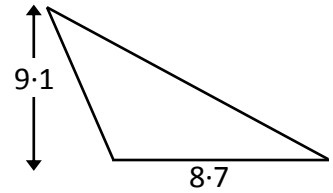

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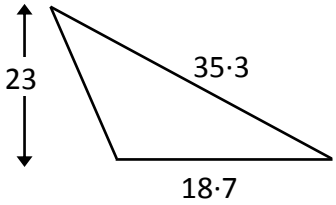

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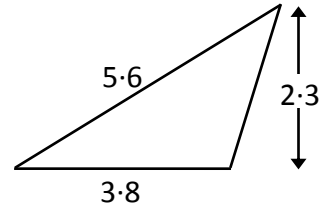
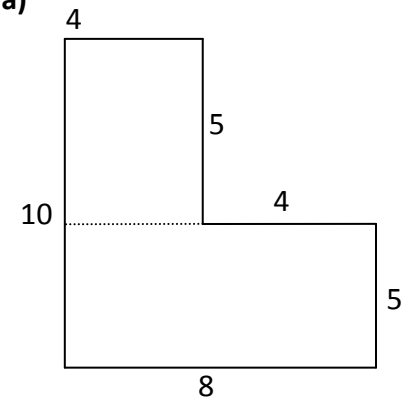


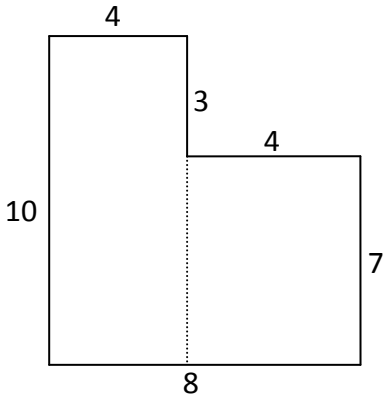
Exercise 4 (remember to include units in your answer – cm^2, m^2, km^2)

1) Work out the area of these shapes (lengths are in metres)

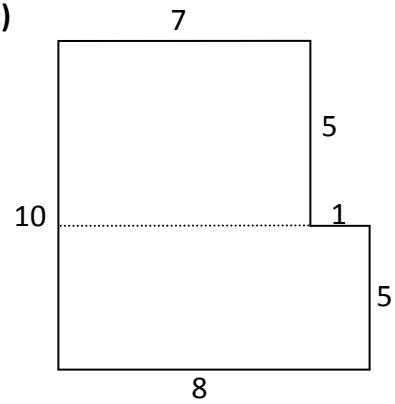
a)



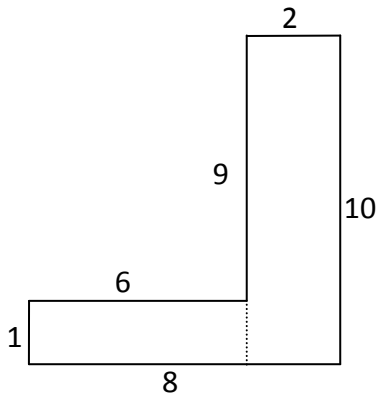
b)



c)

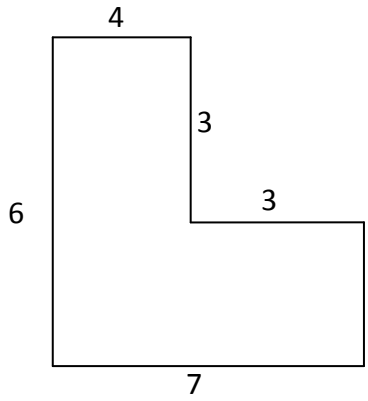


d)

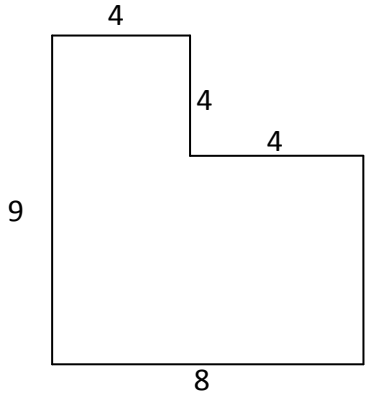


2) Work out the area of these shapes (lengths are in cm).
Watch out! You are missing a side (or two)!

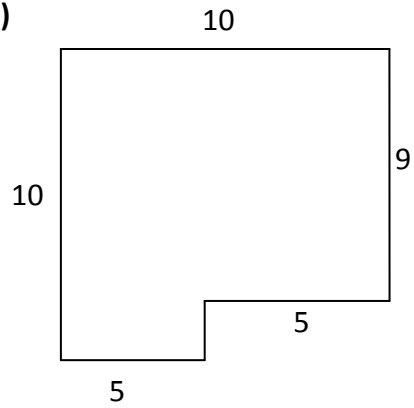
a)



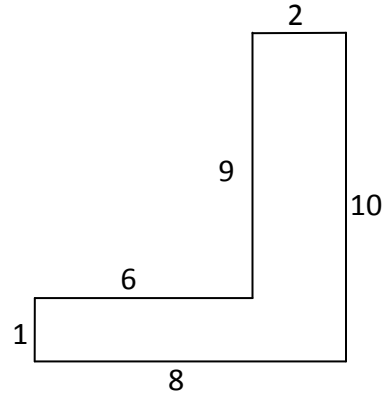
b)



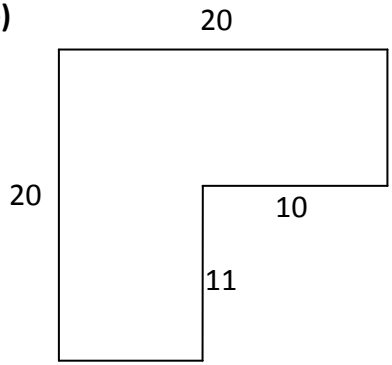
c)



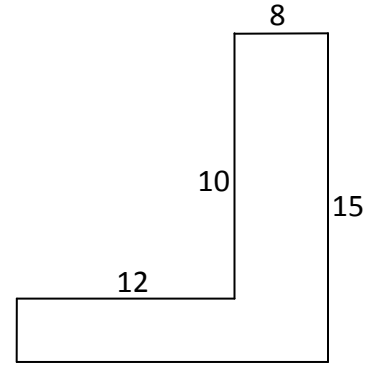
d)



e)

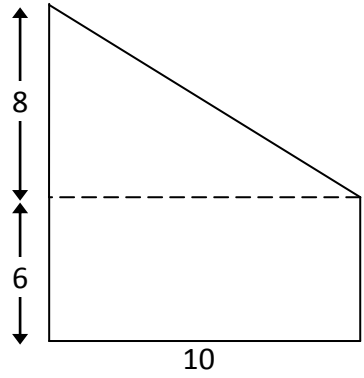


f)

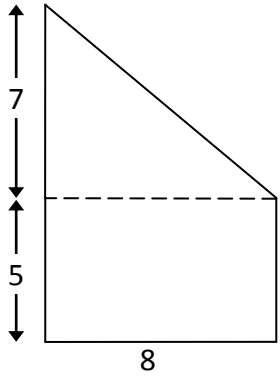


3) Work out the area of these shapes (lengths are in mm).

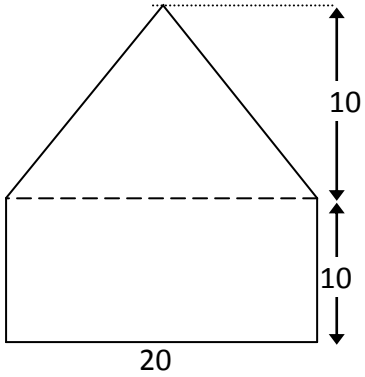
a)



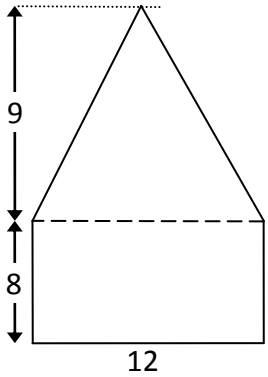
b)



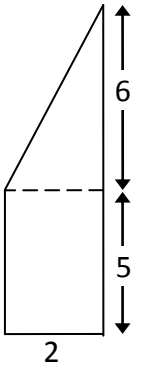
c)



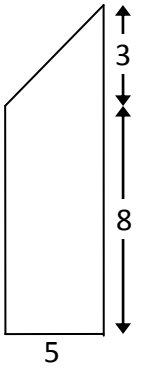
d)



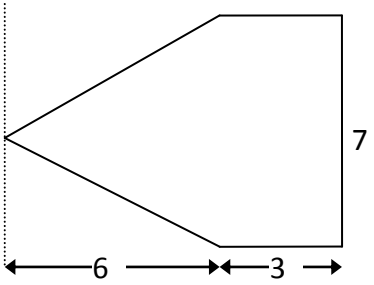
e)



f)

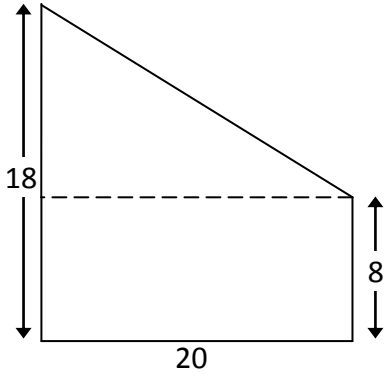


g)

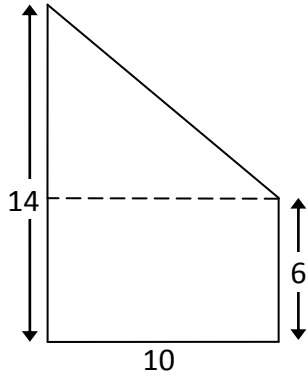


4) Work out the area of these shapes (lengths are in metres).
Watch out! You need to split some lengths first!

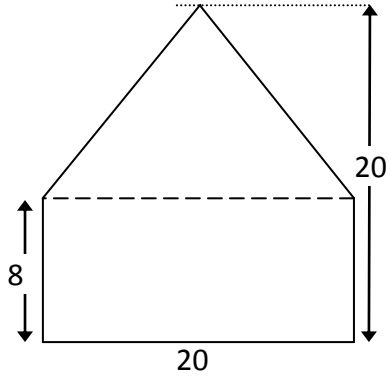
a)



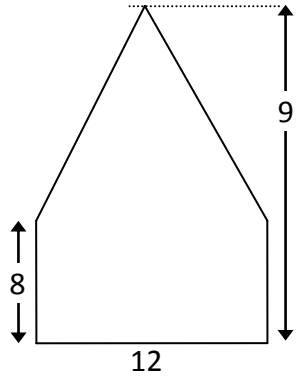
b)



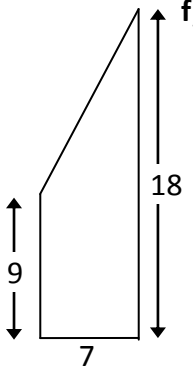
c)



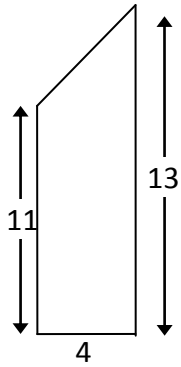
d)



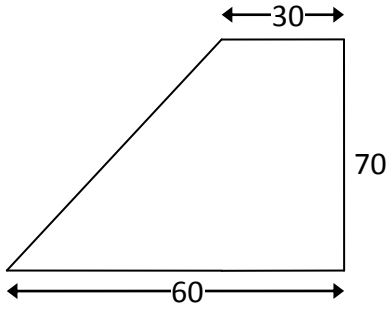
e)



f)



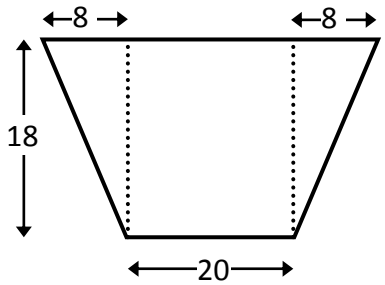
g)



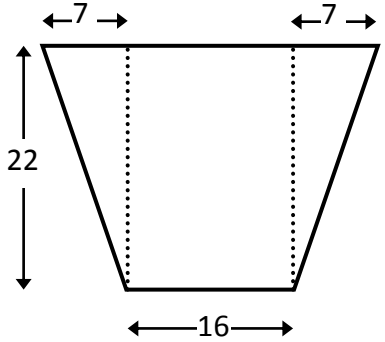
Exercise 5 (remember to include units in your answer – mm^2)

Work out the area of the trapeziums (or trapezia). (lengths are in mm)

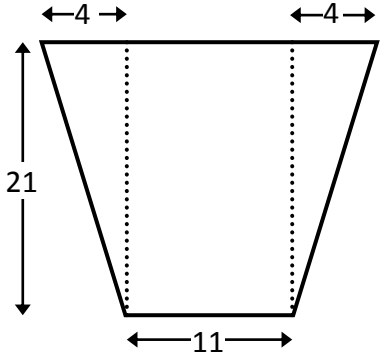
1)



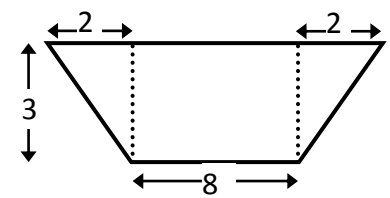
2)



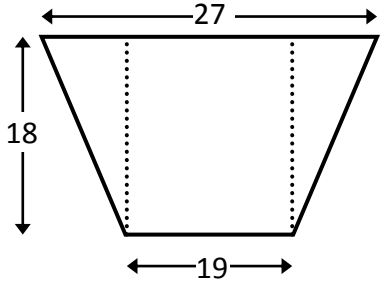
3)



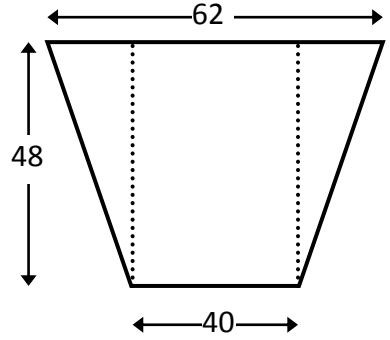
4)



5)



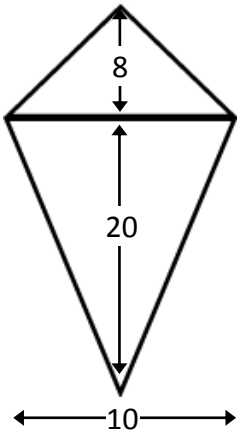
6)



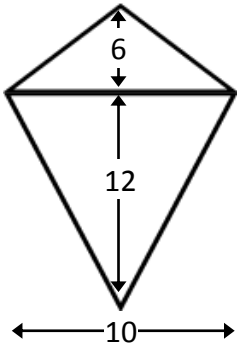
Exercise 6 (remember to include units in your answer – cm^2)

Work out the area of these kites (lengths are in cm)

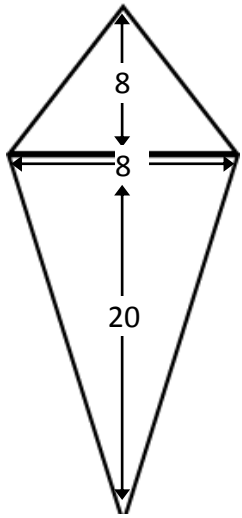
1)



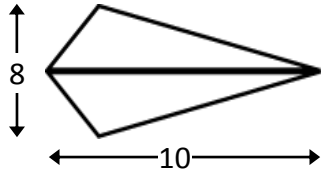
2)



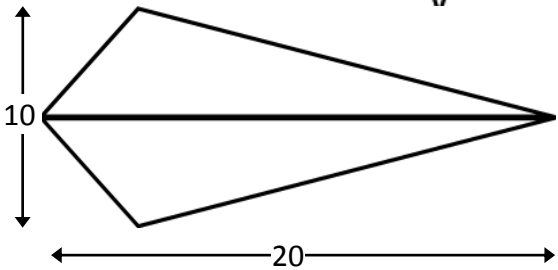
3)



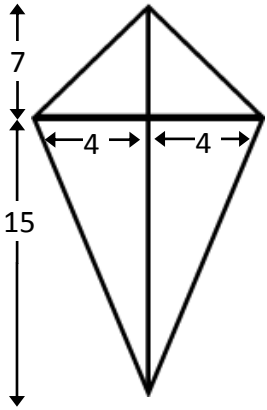
4)



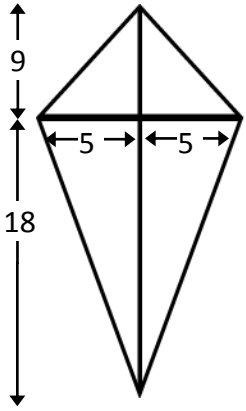
5)



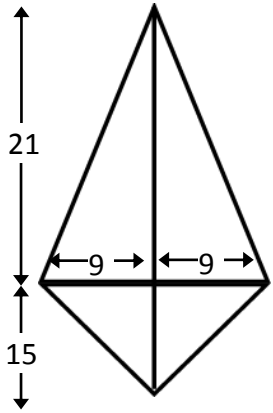
6)



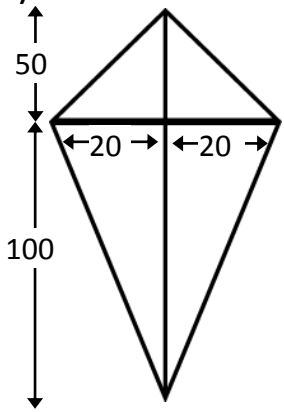
7)



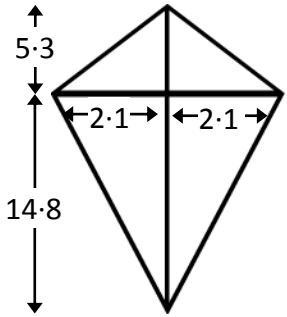
8)



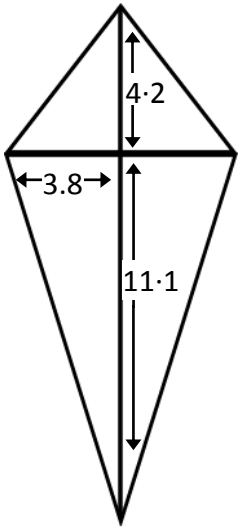
9)



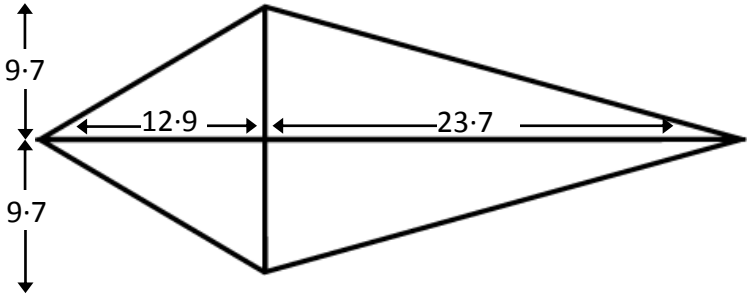
10)



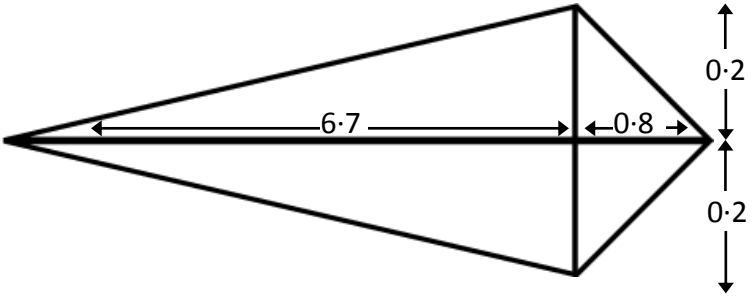
11)



12)



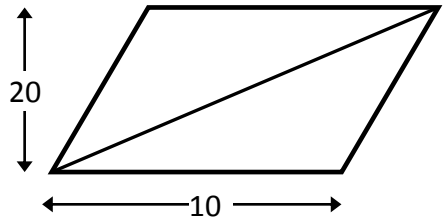
13)



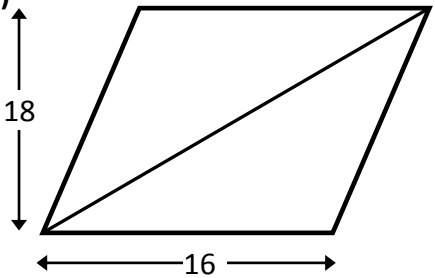
Exercise 7 (remember to include units in your answer – m^2)

Work out the area of the following parallelograms. (lengths are in metres)

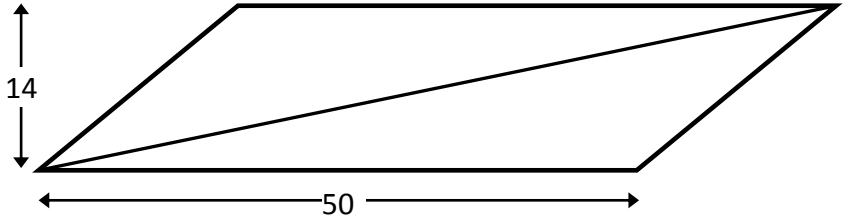
1)



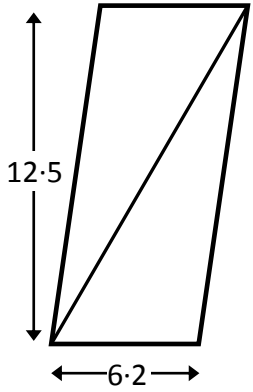
2)



3)



4)



5)