N5 Practice Prelim A – Paper 2

1) $(x+2)(x-5)-9x$

• Start to multiply brackets

$= x^2+2x-5x-10-9x$

• Correct bracket expansion

$= \boxed{x^2-12x-10}$

• Collect like terms to obtain final answer

Strategy:

Multiply out the brackets and simplify as much as possible, normally by collecting like terms.

2) £750 000 ÷ 2

= £375 000

After 1 year:

• Decrease by 20%

£750 000 × 0·8 = £600 000

After 2 years:

£600 000 × 0·8 = £480 000

After 3 years:

• Correct strategy

£480 000 × 0·8 = £384 000

After 4 years:

• Continue until value less than half is reached

£384 000 × 0·8 = £307 200

As £307 200 < £375 000, the machinery should be replaced after 4 years.

• Answer with valid comparison

Strategy:

Work out half of £750 000. Multiply £750 000 by 0·8

(20% depreciation means 80% = 0·8 is the value not depreciated)

and continue multiplying by 0·8 until half the original amount is left; the number of times the original amount was × 0·8 is the number of years. Compare amounts.

3) Reduction SF $\equiv k$

$k = \frac{50}{80} \Rightarrow k = \frac{5}{8}$ • Obtain SF

$\therefore k^2 = \frac{25}{64}$ • Obtain area SF

$A_s = k^2 \times A_L$

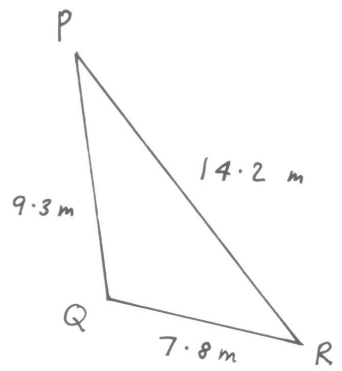
$\therefore A_s = \frac{25}{64} \times 7680$

$\Rightarrow \boxed{A_s = 3000 \text{ cm}^2}$ • Obtain answer

Strategy:

Area of smaller flag needed, so reduction SF; square to get area SF, then multiply by larger flag area.

4)



Strategy:

3 sides given and angle required, so Cosine Rule for angle.

(Let $P = Q\hat{P}R$)

• Cosine Rule

$\cos P = \frac{q^2 + r^2 - p^2}{2qr}$

$(p = 7{\cdot}8, q = 14{\cdot}2, r = 9{\cdot}3)$

$\therefore \cos P = \frac{(14{\cdot}2^2 + 9{\cdot}3^2 - 7{\cdot}8^2)}{(2 \times 14{\cdot}2 \times 9{\cdot}3)}$ • Correct substitution

$\Rightarrow \cos P = 0{\cdot}8605\ldots$

$\therefore \boxed{P = 30{\cdot}6^\circ \text{ (1 d.p.)}}$ • Obtain answer

5) $x^2 - 5x - 2 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

• Use of Quadratic Formula

$(a = 1, b = -5, c = -2)$

Strategy:

Use Quadratic Formula; don't round until final answer.

$$\therefore \quad x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-2)}}{2(1)}$$

• Correct substitution

$$\Rightarrow \quad x = \frac{5 \pm \sqrt{25 + 8}}{2}$$

$$\Rightarrow \quad x = \frac{5 \pm \sqrt{33}}{2}$$

• Calculate $b^2 - 4ac$

$$\therefore \quad x = \frac{(5 + \sqrt{33})}{2}, \quad x = \frac{(5 - \sqrt{33})}{2}$$

$$\Rightarrow \quad x = 5.37\ldots, \quad x = -0.37\ldots$$

$$\therefore \quad \boxed{x = 5.4, \quad x = -0.4}$$

• Answers to 1 d.p.

6) (a) (i) Mean $\equiv \bar{x}$

$$\bar{x} = \frac{(84+78+87+80+81)}{5}$$

$$\therefore \bar{x} = \frac{410}{5} \Rightarrow \boxed{\bar{x} = 82}$$

• Obtain answer

Strategy:

Add all numbers; divide this by how many number there are.

(ii)

x	$\bar{x}$	$x-\bar{x}$	$(x-\bar{x})^2$
84	82	2	4
78	82	−4	16
87	82	5	25
80	82	−2	4
81	82	−1	1

• Obtain $(x-\bar{x})^2$ values

Strategy:

Draw detailed table, then use Standard Deviation Formula.

$$\left(\sum (x-\bar{x})^2 = 4+16+25+4+1 = 50\right)$$

$$s = \sqrt{\frac{\sum (x-\bar{x})^2}{n-1}} \qquad (n=5)$$

$$\therefore s = \sqrt{\frac{50}{4}}$$

• Substitution

$$\Rightarrow \boxed{s = 3.54 \text{ (2 d.p.)}}$$

• Answer

(b)

$$\boxed{\bar{x} = 102}$$

• State $\bar{x}$

$$\boxed{s = 3.54}$$

• State s

Strategy:

When same constant is added to all values, standard deviation is same, but mean is old mean plus constant.

7) $3x^2 - 5x + 6 = 0$

$D = b^2 - 4ac$

$(a = 3, b = -5, c = 6)$

• Use of discriminant

$\therefore D = (-5)^2 - 4(3)(6)$

$\Rightarrow D = 25 - 72$

$\Rightarrow \underline{D = -47}$ • Discriminant value

$\boxed{\text{As } D < 0, \text{ roots are not real}}$ • Conclusion with reason

Strategy:

Calculate discriminant:
$D > 0 \Rightarrow$ 2 distinct real;
$D = 0 \Rightarrow$ 1 real;
$D < 0 \Rightarrow$ 0 real.

8) Volume left after melting is,

• Calculate remaining volume

$V = 0.92 \times 10 \times 10 \times 10$

$\Rightarrow \underline{V = 920 \text{ cm}^3}$

This volume equals the cone volume; so,

• Volume of cone

$\frac{1}{3} \pi r^2 h = 920 \quad (r = 8 \text{ cm})$ • Volumes equated

$\therefore \quad h = \dfrac{920 \times 3}{\pi \times 8^2}$

$\Rightarrow \quad h = 13.72\ldots$ • Obtain h

$\therefore \quad \boxed{h = 14 \ (2 \text{ s.f.})}$

• Correctly rounded answer

Strategy:

Calculate volume of material remaining; equate to cone volume formula and calculate height.

9) $a = 3b^2 + c$

$\quad -c \qquad\qquad -c$

• First step correct

$a - c = 3b^2$

$\div 3 \qquad\qquad \div 3$

$b^2 = \dfrac{a-c}{3}$ • Second step correct

Take square roots of both sides to give,

$\boxed{b = \sqrt{\dfrac{a-c}{3}}}$ • Obtain answer (+ve root assumed)

$$b \xrightarrow{\;2\;} b^2 \xrightarrow{\times 3} 3b^2 \xrightarrow{+c} 3b^2 + c = a$$

$$\sqrt{\frac{a-c}{3}} \xleftarrow{\sqrt{\ }} \frac{a-c}{3} \longleftarrow a-c \xleftarrow[-c]{} 3b^2 + c = a$$

Strategy A:

Use 'opposite of BODMAS'; +, − first, then ×, ÷, then powers.

Strategy B:

Arrow diagrams.

10) $\dfrac{x^6}{y^2} \times \dfrac{y^3}{x^3}$

$= \dfrac{x^6 y^3}{x^3 y^2}$

$= x^{6-3} y^{3-2}$

$= \boxed{x^3 y}$

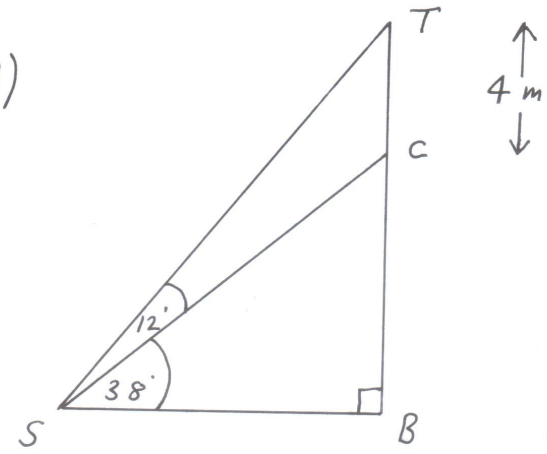
• x^3 or y obtained

• Full simplification

Strategy:

Multiply fractions, then use the rules of indices.

11)



Strategy:

Find $S\hat{C}B$ and thus $S\hat{C}T$ and thus $S\hat{T}C$; use the Sine Rule to get SC, then basic right-angled trig. will give BC.

$S\hat{C}B = 180° - 90° - 38° \Rightarrow \underline{S\hat{C}B = 52°}$

$\therefore S\hat{C}T = 180° - 52° \Rightarrow \underline{S\hat{C}T = 128°}$

$\therefore S\hat{T}C = 180° - 12° - 128° \Rightarrow \underline{S\hat{T}C = 40°}$

$$\frac{SC}{\sin 40°} = \frac{4}{\sin 12°}$$ • Use of Sine Rule

• Correct numbers

$$\Rightarrow SC = \frac{4 \sin 40°}{\sin 12°} \Rightarrow \underline{SC = 12.36\ldots \text{ m}}$$ • Obtain SC

$$\sin 38° = \frac{BC}{SC}$$ • Right-angled trigonometry

$\therefore BC = SC \sin 38°$

$\Rightarrow BC = 12.36\ldots \times \sin 38°$

$\Rightarrow \boxed{BC = 7.6 \text{ m (1 d.p.)}}$

• Obtain BC

12) $\dfrac{3}{x+2} + \dfrac{5}{x-1}$

Strategy:

Obtain common denominator, expand numerator brackets and add.

$= \dfrac{3(x-1)}{(x+2)(x-1)} + \dfrac{5(x+2)}{(x+2)(x-1)}$

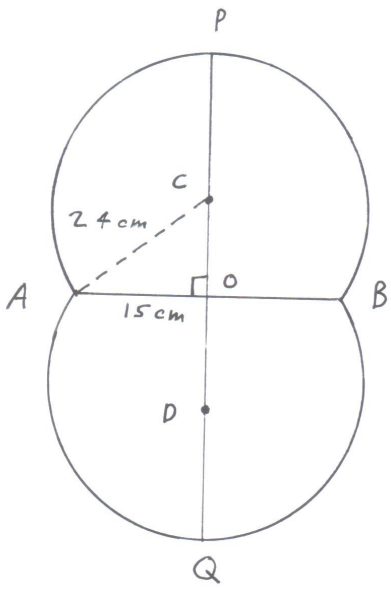
• Obtain correct denominator

$= \dfrac{(3x-3) + (5x+10)}{(x+2)(x-1)}$

• Add numerators

$= \boxed{\dfrac{8x+7}{(x+2)(x-1)}}$ • Obtain answer

13)



Strategy:

Draw AC to make a right-angled triangle AOC; use Pythagoras' Th^m to calculate OC, then add PC, OC, OD and DQ to get PQ.

(By symmetry, $AO = \frac{1}{2} AB = 15$ cm; also, $OC = OD$.) • Bisecting property used

• Obtain right-angled triangle

$OC^2 = 24^2 - 15^2$ • Use of Pythagoras' Th^m

$\therefore OC^2 = 576 - 225$

$\Rightarrow OC^2 = 351$

$\Rightarrow \underline{OC = 18.73...}$ • Obtain OC

$\therefore PQ = 18.73... + 18.73... + 24 + 24$

$\Rightarrow \boxed{PQ = 85.5 \text{ cm } (1 \text{ d.p.})}$ • Obtain height

14) $h = 7 + 5\sin t^\circ$

$h = 10.8$

• Substitute h

$\therefore \quad 7 + 5\sin t^\circ = 10.8$

$\Rightarrow \quad 5\sin t^\circ = 3.8$

$\Rightarrow \quad [\sin t^\circ = 0.72]$ • Obtain $\sin t^\circ = \ldots$

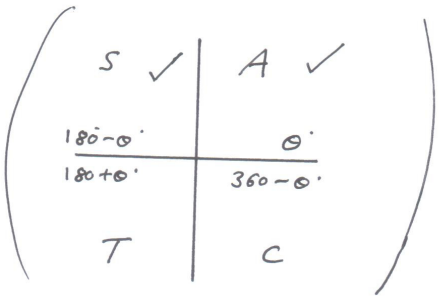
Related angle $= \sin^{-1}(0.72)$

$\Rightarrow$ Related angle $= 49.46\ldots^\circ$

By [...], $\sin t^\circ$ is positive, so, using the ASTC diagram,

$t^\circ = 49.46\ldots^\circ$,

$t^\circ = 180^\circ - 49.46\ldots^\circ$



i.e.,

$$\boxed{t = 49.5\text{ s and } t = 130.5\text{ s (1 d.p.)}}$$

• Obtain one angle • Obtain other angle

Strategy:

Substitute value of h into given equation; rearrange to get $\sin t^\circ = \ldots$, then solve using ASTC diagram.