

N5 Practice Prelim B - Paper 2

$$1) L = \frac{\theta^\circ}{360^\circ} \times 2\pi r$$

$$(\theta^\circ = 110^\circ; 2\pi r = 40.8 \text{ cm})$$

$$\therefore L = \frac{110^\circ}{360^\circ} \times 40.8$$

• Angle fraction

$$\Rightarrow L = 12.5 \text{ cm (1 d.p.)}$$

• Obtain answer

Strategy:

Use the arc length formula.

$$2) (3x - 5)(x^2 + 2x - 6)$$

• Begin expanding brackets

$$= 3x^3 + 6x^2 - 18x$$

$$- 5x^2 - 10x + 30$$

$$= 3x^3 + x^2 - 28x + 30$$

• Complete expanding brackets

• Fully simplified answer

Strategy:

Expand brackets and simplify by collecting like terms.

$$3) V_c = \pi r^2 h \quad (r=4, h=15)$$

$$\therefore V_c = \pi \times 4^2 \times 15$$

• Cylinder volume

$$\Rightarrow V_c = 753.982... \text{ mm}^3$$

$$V_s = \frac{4}{3} \pi r^3 \quad (r=4)$$

$$\therefore V_s = \frac{4}{3} \times \pi \times 4^3$$

• Sphere volume

$$\Rightarrow V_s = 268.082... \text{ mm}^3$$

$$V_T = V_s + V_c$$

• Add volumes

$$\therefore V_T = 753.982... + 268.082...$$

$$\Rightarrow V_T = 1022.06 \text{ mm}^3$$

• Obtain answer

Strategy:

Capsule volume is cylinder volume plus two hemispheres' volumes; radius = $\frac{1}{2}(23-15)$.

$$4) \quad 3x^2 + 7x - 5 = 0$$

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

• Use of Quadratic Formula
($a = 3, b = 7, c = -5$)

Strategy:

Use Quadratic Formula;
only round at end.

$$\therefore x = \frac{-7 \pm \sqrt{7^2 - 4(3)(-5)}}{2(3)} \quad \bullet \text{ Correct substitution}$$

$$\Rightarrow x = \frac{-7 \pm \sqrt{49 + 60}}{6}$$

$$\Rightarrow x = \frac{-7 \pm \sqrt{109}}{6} \quad \bullet \text{ Calculate } b^2 - 4ac$$

$$\therefore x = \frac{(-7 + \sqrt{109})}{6}, \quad x = \frac{(-7 - \sqrt{109})}{6}$$

$$\Rightarrow x = 0.57\dots, \quad x = -2.90\dots$$

$$\therefore \boxed{x = 0.6, \quad x = -2.9}$$

• Answers to 1 d.p.

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

$$\bar{x} = \frac{(134+102+127+98+104+131)}{6}$$

$$\therefore \bar{x} = \frac{696}{6}$$

$$\Rightarrow \bar{x} = 116 \quad \bullet \text{ Obtain answer}$$

Strategy:

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

(ii)

x	\bar{x}	$x - \bar{x}$	$(x - \bar{x})^2$
134	116	18	324
102	116	-14	196
127	116	11	121
98	116	-18	324
104	116	-12	144
131	116	15	225

\bullet Obtain $(x - \bar{x})^2$ values

$$\left(\sum (x - \bar{x})^2 = 324 + 196 + 121 + 324 + 144 + 225 = 1334 \right)$$

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}} \quad (n = 6)$$

$$\therefore s = \sqrt{\frac{1334}{5}} \quad \bullet \text{ Substitution}$$

$$\Rightarrow s = 16.333\dots$$

$$\therefore s = 16.3 \text{ (1 d.p.)} \quad \bullet \text{ Answer}$$

Strategy:

Draw detailed table, then use Standard Deviation Formula.

(b) Means same \Rightarrow totals same.
's' bigger in first match.

So, only 1 and 4 are true.

- \bullet 1 correct answer
- \bullet 2 correct answers

Strategy:

Compare total scores; bigger value of 's' means scores more spread out.

6) (a)

$$6x + 2y = 3148$$

• Obtain equation

Strategy:

Multiply cost by number of adults or children; add.

(b)

$$5x + 3y = 3022$$

• Obtain equation

Strategy:

Same as previous.

(c) $6x + 2y = 3148$ ① $\times 3$

$5x + 3y = 3022$ ② $\times 2$

• Equations scaled correctly

$\therefore 18x + 6y = 9444$ ③

$10x + 6y = 6044$ ④

③ - ④ $8x = 340$

$\therefore x = 425$ • Solve for x

Substitute $x = 425$ into ① :

$$6x + 2y = 3148$$

$\therefore 6(425) + 2y = 3148 \Rightarrow 2y = 598 \Rightarrow y = 299$ • Solve for y

Third group cost is,

$$2(\pounds 425) + 4(\pounds 299) = \pounds 850 + \pounds 1196 = \pounds 2046$$

Yes, the third group has been overcharged by $\pounds 10$.

• Conclusion with reason

$$\begin{aligned}
 7) \quad & \frac{a}{b} + \frac{b}{a} \\
 &= \frac{a \times a}{b \times a} + \frac{b \times b}{a \times b} \\
 & \quad \bullet \text{ Get common denominator} \\
 &= \frac{a^2}{ab} + \frac{b^2}{ab} \\
 &= \boxed{\frac{a^2 + b^2}{ab}} \quad \bullet \text{ Obtain answer as a single fraction}
 \end{aligned}$$

Strategy:
Get same denominator; add numerators.

$$\begin{aligned}
 8) \quad & 5 \cos x^\circ - 3 = 1 \\
 & (0 \leq x \leq 360) \\
 & 5 \cos x^\circ = 4 \\
 \Rightarrow & \left[\cos x^\circ = \frac{4}{5} \right]
 \end{aligned}$$

Strategy:
Rearrange to get $\cos x^\circ = \dots$; then solve using ASTC diagram.

• Solve for $\cos x^\circ$

$$\text{Related angle} = \cos^{-1}\left(\frac{4}{5}\right)$$

$$\Rightarrow \text{Related angle} = 36.86\dots^\circ$$

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

$$x^\circ = 36.86\dots^\circ,$$

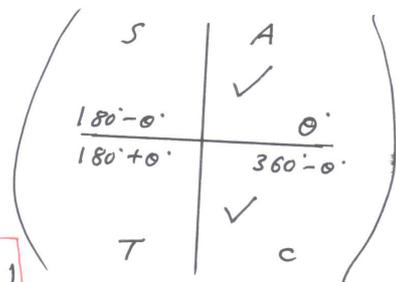
$$x^\circ = 360^\circ - 36.86\dots^\circ$$

i.e.,

$$\boxed{x^\circ = 36.9^\circ, x^\circ = 323.1^\circ \text{ (1 d.p.)}}$$

• Obtain one angle

• Obtain other angle



$$9) \quad E = \frac{I}{D^2}$$

$$\times D^2 \qquad \times D^2$$

$$D^2 E = I \quad \bullet \text{ First step correct}$$

$$\div E \qquad \div E$$

$$D^2 = \frac{I}{E} \quad \bullet \text{ Second step correct}$$

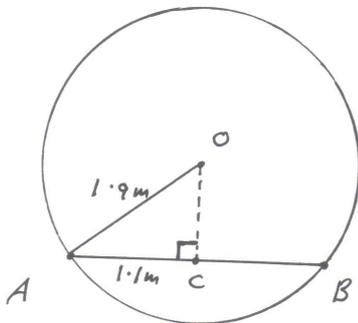
Take square roots of both sides to give,

$$D = \sqrt{\frac{I}{E}} \quad \bullet \text{ Obtain answer (+ve root assumed)}$$

(Question should say 'solve for D')

Strategy:
Clear fractions,
then solve for D.

10)



• Obtain right-angled triangle

$$OC^2 = 1.9^2 - 1.1^2$$

$$\therefore OC^2 = 3.61 - 1.21$$

$$\Rightarrow OC^2 = 2.4$$

$$\Rightarrow OC = 1.549\dots$$

• Use of Pythagoras' Th^m

• Obtain OC

$$\therefore \text{Depth} = 1.9 - 1.549\dots$$

$$\Rightarrow \text{Depth} = 0.35 \text{ m (2 d.p.)} \quad \bullet \text{ Obtain depth}$$

Strategy:
Draw vertical line OC,
which is perpendicular to AB;
use Pythagoras' Th^m to
calculate OC, then subtract
this from radius to get depth.

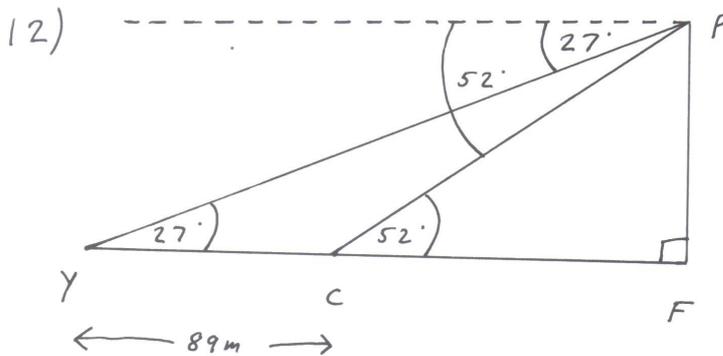
$$\begin{aligned}
 11) \quad & (x^2 y^4) \div (x^{-3} y^6) \\
 & = (x^2 \times y^4) \div (x^{-3} \times y^6) \\
 & = (x^2 \div x^{-3}) \times (y^4 \div y^6) \\
 & = x^{2-(-3)} y^{4-6} \\
 & = x^5 y^{-2} \\
 & = \boxed{\frac{x^5}{y^2}}
 \end{aligned}$$

Strategy:

Rules of indices;
then get all indices
positive by rewriting.

• x^5 or y^{-2} obtained

• Answer with positive indices



Strategy:

Use Sine Rule to
get CP; then
basic right-angled
trig. to get h.

$$\begin{aligned}
 \frac{CP}{\sin 27^\circ} &= \frac{89}{\sin 25^\circ} \quad \bullet \text{ Use of Sine Rule} \\
 \bullet \text{ Correct numbers} \\
 \therefore CP &= \frac{89 \sin 27^\circ}{\sin 25^\circ} \Rightarrow \underline{CP = 95.606... \text{ m}} \quad \bullet \text{ Obtain CP}
 \end{aligned}$$

$$\sin 52^\circ = \frac{h}{CP} \quad \bullet \text{ Right-angled trigonometry}$$

$$\therefore h = CP \sin 52^\circ$$

$$\Rightarrow h = 95.606... \times \sin 52^\circ$$

$$\Rightarrow \boxed{h = 75.3 \text{ m (1 d.p.)}} \quad \text{Obtain } h$$

13)

• Decrease by 15%

$$\% \text{ left after 10 years} = 0.85 \times 100\%$$

$$\% \text{ left after 20 years} = (0.85)^2 \times 100\%$$

$$\% \text{ left after 30 years} = (0.85)^3 \times 100\%$$

$$\% \text{ left after 40 years} = (0.85)^4 \times 100\%$$

$$(0.85)^4 = 0.522\dots$$

- Continue till required year
- Obtain value

Strategy:

Obtain percentage left after first 10 year reduction (0.85); continue till $(0.85)^4$ and compare with 0.5.

So, as the percentage of greenhouse gases remaining after 40 years is 52.2% ($> 50\%$), the recommendations have not been achieved.

- Conclusion with valid reason

14)

$$\frac{\cos \alpha \tan \alpha}{\sin \alpha}$$

$$= \frac{\frac{\cos \alpha}{1} \times \frac{\sin \alpha}{\cos \alpha}}{\sin \alpha}$$

$$= \frac{\sin \alpha}{\sin \alpha}$$

$$= \boxed{1}$$

- Use of $\tan \alpha = \frac{\sin \alpha}{\cos \alpha}$

- Simplify fully

Strategy:

Use $\tan \alpha = \frac{\sin \alpha}{\cos \alpha}$ and simplify.