HSoG N5 Model Papers

Paper B: 1

(1) $7.18 - 2.1 \times 3$ (Multiply first $\rightarrow 6.3$)

$$\begin{array}{r} {}^{6}7.18 \\ -\ 6.30 \\ \hline 0.88 \end{array} \quad = \underline{0.88}$$

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(2) $1\frac{1}{8} \div \frac{3}{4} = \frac{9}{8} \div \frac{3}{4} = \frac{9}{8} \times \frac{4}{3}$ ← (turn 2nd fraction upside down, $\div \rightarrow \times$)

$8 \times 1 + 1 = 9$

$= \frac{36}{24}$ $(\div 12)$

$(3 \div 2 = 1 \text{ r } 1) \longrightarrow = \frac{3}{2} = \underline{1\frac{1}{2}}$

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(3) $(5 - x) > 2(x + 1)$ ← Remove brackets

$\Rightarrow 5 - x > 2x + 2$ $(-2x)$

$\Rightarrow 5 - 3x > 2$ (-5)

$\Rightarrow -3x > -3$ $(\div (-3)) \Rightarrow x < \frac{-3}{-3}$ (change direction when $\div$ by -ve)

$\Rightarrow \underline{x < 1}$

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(4) $f(-3) = (-3)^2 + 5 \times (-3)$ (Replace x by (-3))

$= 9 + (-15) = \underline{-6}$

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(5) $4\underline{u} - 2\underline{v} = 4\begin{pmatrix} 3 \\ -2 \\ -1 \end{pmatrix} - 2\begin{pmatrix} 2 \\ -4 \\ 1 \end{pmatrix}$

$= \begin{pmatrix} 12 \\ -8 \\ -4 \end{pmatrix} - \begin{pmatrix} 4 \\ -8 \\ 2 \end{pmatrix} = \begin{pmatrix} 8 \\ 0 \\ -6 \end{pmatrix}$

$\begin{bmatrix} 4 \times 3 \\ 4 \times (-2) \\ 4 \times (-1) \end{bmatrix} = \begin{pmatrix} 12 \\ -8 \\ -4 \end{pmatrix}$

$\begin{bmatrix} 12 - 4 = 8 \\ (-8) - (-8) = 0 \\ (-4) - 2 = (-6) \end{bmatrix}$

$|4\underline{u} - 2\underline{v}| = \sqrt{8^2 + 0^2 + 6^2}$

$= \sqrt{100}$

$= \underline{10 \text{ units}}$

(6) a) $p^2 - 4q^2$

$= (p)^2 - (2q)^2 = \underline{\underline{(p+2q)(p-2q)}}$ (Difference of 2 squares)

b) $\dfrac{p^2 - 4q^2}{3p + 6q} = \dfrac{(p+2q)(p-2q)}{3(p+2q)} = \underline{\underline{\dfrac{p-2q}{3}}}$

Common factor = 3

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(7) $y = mx + c$ Meets y-axis at $(0,5)$ so $c = 5$

2 points on graph: $(0,5)$ and $(2,10)$ (or other points)

$x_1\ y_1 \qquad x_2\ y_2$

$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{10-5}{2-0}$

$= \dfrac{5}{2}$ So Eqn. is: $\underline{\underline{y = \frac{5}{2}x + 5}}$

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(8)

✓S	A
✓T	C

($60°$ is related acute angle)

x is in Quadrant 2 or 3 (its cosine is -ve)

Q2: $180 - 60 = 120$

Q3: $180 + 60 = 240$

$\underline{\underline{x = 120 \text{ or } 240}}$

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(9) $(x-3)(x^2 + 4x - 1)$

$= \underbrace{x^3 + 4x^2 - x}_{x(x)} \underbrace{- 3x^2 - 12x + 3}_{x(-3) \rightarrow \text{careful with -ve}}$

$= \underline{\underline{x^3 + x^2 - 13x + 3}}$

(10) a) (Data in order) – 21 students, $n = 21$

1, 1, 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 5, 6

Median (Q_2) is 11th $\left(\frac{21+1}{2} = 11\right) = 3$

Lower q'tile (Q_1) is 5th/6th : $\frac{1.5}{}$ (Mean of 1 and 2)

Upper q'tile (Q_3) is 16th/17th : $\frac{4}{}$ ← 5th/6th of upper 10

b) Semi-interquartile range : $\frac{Q_3 - Q_1}{2} = \frac{4 - 1.5}{2} = \frac{2.5}{2} = 1.25$

c) Students appear to have attended football more often than cinema, but with more varied results (within that group).

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(11) (Solve) $x^2 + 2x - 1 = 5x + 3$ (make right side = 0)

$x^2 - 3x - 1 = 3$ (−5x)

$x^2 - 3x - 4 = 0$ (−3)

$(x+1)(x-4) = 0$ (Factors of (−4)) +1, −4, −3 ✓

$x + 1 = 0$ $(x - 4) = 0$

$\Rightarrow x = -1$ $\Rightarrow x = 4$

$x = -1$ or 4

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(12) $y^8 \times (y^3)^{-2}$

$= y^8 \times y^{-6}$ (Brackets: "power of a power" → multiply)

$= y^2$ (Multiply terms → add powers/indices).

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(13) a) $(1, -16)$ ($y = (x-1)^2 - 16$, $x - 1 = 0 \Rightarrow x = 1$ and $y = 0^2 - 16 = -16$)

b) $x = 1$ (parallel to $x = 0$ i.e. the y-axis)

(14) a) $\sqrt{45} - 2\sqrt{5}$ (Simplify $\sqrt{45}$: look for a factor that's a "perfect square")

$= \sqrt{9 \times 5} - 2\sqrt{5}$

$= \sqrt{9} \times \sqrt{5} - 2\sqrt{5} = 3\sqrt{5} - 2\sqrt{5}$

$= \underline{\sqrt{5}}$ (i.e. $1\sqrt{5}$)

b) $\frac{1}{x^2} + \frac{1}{x}$ (LCM is x^2)

$= \frac{1}{x^2} + \frac{x}{x^2}$ ← ($X(x)$ top/bottom)

$= \underline{\underline{\frac{1+x}{x^2}}}$

Paper B:2

(1) $19{\cdot}06 \times 10^{-5}$ (Dec. pt. moves 5 places left)

$= 0{\cdot}0001906$

(X18 for humming bird) (X18)

$= 0{\cdot}0034308$

$= \underline{3{\cdot}431 \times 10^{-3}\ (kg)}$ (change back to sci. not.)

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(2) Price (before VAT added) = 100%

VAT (20%) added = 120% = £150

So 100% = $\underbrace{150 \div 120}_{(1\%)} \times 100 = \underline{£125}$ (before VAT)

(DO NOT calculate 20% of £150 and subtract)

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(3) a) Mean $= \frac{(\text{Total})}{6} = \frac{438}{6}$ (6 prices → ÷6) $n = 6$

$= \underline{73}$

x	$(x-\bar{x})$	$(x-\bar{x})^2$
66	-7	49
70	-3	9
89	+16	256
75	+2	4
79	+6	36
59	-14	196
	(Total)	550

($\bar{x}$ = mean = 73)

(Σ in the formula)

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

$$= \sqrt{\frac{550}{5}} = \sqrt{110}$$

$$= \underline{10.49 \text{ (to 2 dec. pl)}}$$

b) The mean, or average, price of milk is the same as in the supermarkets, but there is a wider spread of prices.

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(4) Arc length $= \frac{x}{360} \times \pi \times D$ ($r = 20$ so $D = 40$)

$$28.6 = \frac{x}{360} \times (\pi \times 40) \quad (\times 360)$$

$$10296 = x \times (\pi \times 40)$$

$$x = \frac{10296}{40\pi} = \underline{81.9^\circ}$$

(82.0° if 3.14 used for π)

(40 × π in brackets on calculator)

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(5) V (full cone) $= \frac{1}{3}\pi r^2 h$ ($r = 8$, $h = 32$)

$$= \frac{\pi \times 8^2 \times 32}{3} = 2145 \text{ cm}^3$$

V (top part) $= \frac{1}{3}\pi r^2 h$ ($r = 5$, $h = 20$)

$$= \frac{\pi \times 5^2 \times 20}{3} = 524 \text{ cm}^3$$

(5) cont. $V(\text{container}) = V(\text{full cone}) - V(\text{top part})$

$= 2145 - 524$

$= 1621 = \underline{1600\text{cm}^3 \text{ (to 1 sig. fig.)}}$

(Intermediate answers vary slightly if 3·14 used for π)

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(6) $2x^2 + 3x - 1 = 0$ $\quad a = 2,\ b = 3,\ c = -1$

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

$$= \frac{-3 \pm \sqrt{9^2 - 4 \times 2 \times (-1)}}{2 \times 2} = \frac{-3 \pm \sqrt{81 - (-8)}}{4}$$

$$x = \frac{-3 + \sqrt{89}}{4} \text{ or } \frac{-3 - \sqrt{89}}{4} = 1{\cdot}608\ldots \text{ or } -3{\cdot}108\ldots$$

$\underline{x = 1{\cdot}6 \text{ or } -3{\cdot}1 \text{ (correct to 1 dec. pl)}}$

["Give answers correct to... - it won't factorise!]

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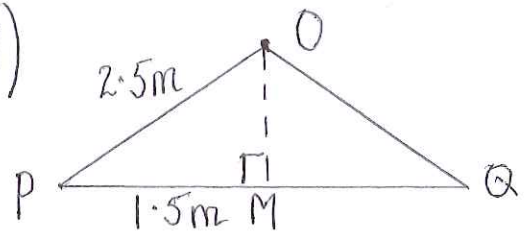
(7)



[ΔOPQ is isosceles since OP = OQ = radius
PM = 3 ÷ 2 = 1·5m]

$OM^2 = 2{\cdot}5^2 - 1{\cdot}5^2$ (Pythagoras)

$= 6{\cdot}25 - 2{\cdot}25$

$= 4$ So $OM = \sqrt{4} = 2$

$\underline{\text{Depth of oil} = 0{\cdot}5\text{m}}$ (radius − OM : 2·5 − 2)

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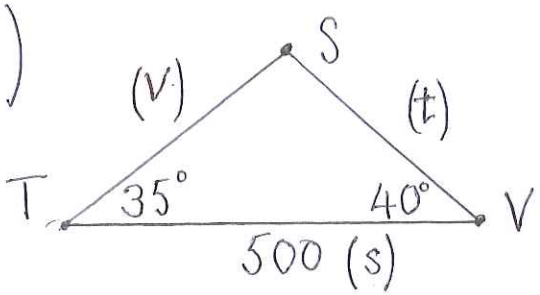
(8)

	'N' town	A' town
1 year	52500 (50 000 × 1·05)	86400 (108000 × 0·8)
2 years	55125 (50000 × 1·05²)	69120 (108000 × 0·8²)
3 years	57881	55296 ←

[5% = 0·05
1 + 0·05 = 1·05
20% = 0·2
1 − 0·2 = 0·8]

$\underline{\text{After 3 years}}$

(9)

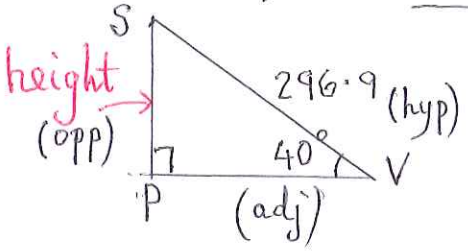


$\angle S(T\hat{S}V) = 105^\circ$ $(180 - 40 - 35)$

(Sine Rule) $\frac{s}{\sin S} = \frac{t}{\sin T}$ (or $\frac{v}{\sin V}$)

$\Rightarrow \frac{500}{\sin 105^\circ} = \frac{t}{\sin 35^\circ}$ $(\times \sin 35^\circ)$

$\Rightarrow t = \frac{500 \times \sin 35^\circ}{\sin 105^\circ} = 296{\cdot}9$



$\sin 40^\circ = \frac{opp}{hyp} = \frac{SP}{296{\cdot}9}$ $(\times 296{\cdot}9)$

$SP = \sin 40^\circ \times 296{\cdot}9 = 190{\cdot}4$

Satellite's height = 190·8 km

(Similar method if "v" calculated)

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(10) $r = 3p - 2t$ or $3p - 2t = r$

$3p = r + 2t$ $(+2t)$

$\Rightarrow p = \frac{(r+2t)}{3}$ $(\div 3)$

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(11) a) F = (5, 3, 0)

(on the "floor" of the box so z-coord = 0)

b) G = (0, 3, 0)

c) D $(0, 3, 1)$ (x_1, y_1, z_1) and C $= (5, 0, 0)$ (x_2, y_2, z_2)

(Distance formula in 3-D).

$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2 + (z_2-z_1)^2}$

$= \sqrt{(5-0)^2 + (0-3)^2 + (0-1)^2} = \sqrt{5^2 + (-3)^2 + 1^2}$

(11) cont. $= \sqrt{25+9+1} = \sqrt{35} = 5.92$ units (to 3 sig. fig)

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(12) a) $t = 10$: $H = 10 + 5\sin 10^\circ$

$= 10 + 0.868$

Height $= 10.868$ m

b) $H = 12.5$ $\quad 12.5 = 10 + 5\sin t^\circ$

$2.5 = 5\sin t^\circ \quad (-10)$

$\sin t^\circ = \frac{2.5}{5} \quad (\div 5)$

$\sin t^\circ = 0.5$

S ✓	A ✓
T	C

($\sin t^\circ$ is +ve → t° in Quadrants 1 or 2)

Q1 : $t^\circ = 30^\circ$ (straight from calculator)

Q2 : $t = 180 - 30$

$= 150$

30s and 150s after wheel starts

(First 2 times: $0 \leq t < 360$)