H S o G N5 Model Papers

Paper C : 1

(1) $5 \cdot 04 + 8 \cdot 4 \div 7$

$$7 \overline{)8 \cdot 4} = 1 \cdot 2$$

(Divide first)

$$= 5 \cdot 04 + 1 \cdot 2$$

$$\begin{array}{r} 5 \cdot 04 \\ +1 \cdot 2 \\ \hline 6 \cdot 24 \end{array}$$

$$= \underline{6 \cdot 24}$$

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(2) $\frac{2}{7}\left(1\frac{3}{4} + \frac{3}{8}\right)$

(Brackets first)

$$= 1\left(\frac{3}{4} + \frac{3}{8}\right) \quad \text{(LCM = 8)}$$

$$\times 2$$

$$= 1\left(\frac{6}{8} + \frac{3}{8}\right) = 1\left(\frac{9}{8}\right)$$

$$= 1 + 1\tfrac{1}{8} = 2\tfrac{1}{8}$$

$$\frac{2}{7} \times 2\frac{1}{8} = \frac{2}{7} \times \frac{17}{8} \quad (2 \times 8 + 1)$$

$$= \frac{34}{56} \; (\div 2) \quad = \underline{\frac{17}{28}}$$

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

(Careful with negative : signs reverse)

$$= 6x - 12 - (12x + 4)$$

$$= 6x - 12 - 12x - 4$$

$$= \underline{-6x - 16}$$

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(4) a) $f(x) = 7 - 4x \Rightarrow f(-2) = 7 - 4 \times (-2)$

$$= 7 - (-8)$$

$$= \underline{15}$$

b) $f(t) = 9 \Rightarrow 7 - 4t = 9$

$$-4t = 2 \quad (-7)$$

$$t = \frac{2}{-4} \quad (\div(-4))$$

$$\Rightarrow \underline{t = -\tfrac{1}{2} \text{ (or } -0 \cdot 5)}$$

(5) $7 + 6x - x^2 = 0$ $\quad (\times(-1))$ ← (So that x^2 term is +ve)

$\Rightarrow x^2 - 6x - 7 = 0$

$\Rightarrow (x-7)(x+1) = 0$ $\quad$ (Factors of (-7))

$7 \oplus -1 = +6$ ✗ $\quad -7 \oplus +1 = -6$ ✓

So $x - 7 = 0$ or $x + 1 = 0$

$\Rightarrow x = 7$ $\quad \Rightarrow x = -1$

$\underline{\underline{x = 7 \text{ or } -1}}$

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(6) Data, in order:

6, 7, 12, 13, 14, 25, 26, 29, 29, 32, 35, 37, 42, 44

($n = 14$ → 14 data)

(a)(i) Median (Q2) is $\left(\frac{14+1}{2}\right) = 7{\cdot}5$ position

$= \frac{26+29}{2} = \underline{\underline{27{\cdot}5}}$ (take mean of 7th/8th position)

(ii) Low q'tile (Q1) is 4th position $= \underline{\underline{13}}$

i.e. Median of "lower" 7 $\left(\frac{7+1}{2} = 4\right)$

(iii) Upper q'tile (Q3) is 11th position $= \underline{\underline{35}}$ (Median of "upper" 7)

b) Semi int. q'tile range $= \frac{Q_3 - Q_1}{2} = \frac{35-13}{2} = \underline{\underline{11}}$

c) Mean waiting time is the same, but spread of data is much less (so waiting time is more predictable although your taxi doesn't arrive any sooner).

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(7) $\underline{\underline{a = 4, \ b = -30}}$

$\left(y = a \sin(x+b)^\circ\right)$

amplitude $= \frac{1}{2}$(max. − min)

$\frac{1}{2}(4 - (-4))$

$= \frac{1}{2}$ of $8 = \underline{4}$

($b = -30$: base of first "hump" at 210° instead of 180°. Graph moved to $\underline{\text{right}}$ → b is $\underline{-\text{ve}}$ Yes, it is!)

(8) a) $A(\underset{x_1}{-1}, \underset{y_1}{-7})$, $B(\underset{x_2}{4}, \underset{y_2}{3})$ $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3-(-7)}{4-(-1)}$

$= \frac{10}{5} = \underline{\underline{2}}$

b) Line AB: $\underline{\underline{y = 2x - 5}}$ "c" (cuts y-axis at (0,c))

"m" (part a)

c) $(3k, k)$: $k = 2\times(3k) - 5$ (Replace y by "k", x by "3k")

$\Rightarrow k = 6k - 5$ $(-6k)$

$-5k = -5$ $(\div(-5))$

$k = \frac{-5}{-5}$ $\Rightarrow \underline{\underline{k = 1}}$

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(9) a) $x^2 + 6x - 7 = (x+3)^2 - 3^2 - 7$

(6÷2) unwanted "last" term

$\Rightarrow f(x) = (x+3)^2 - 9 - 17$

$= \underline{\underline{(x+3)^2 - 16}}$

b) Turning pt. (min) at $(-3, -16)$ f(x) when $(x+3)^2$

$\underline{\underline{(-3, -16)}}$ (Solve $(x+3)^2 = 0$)

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(10) Cost (1 night) = x a) $\underline{\underline{3x + 2y = 145}}$

Cost (breakfast) = y b) $\underline{\underline{5x + 3y = 240}}$

c) Eqn. a) $\times 5$ $15x + 10y = 725$ (Eliminating x)

b) $\times(-3)$ ⊕ $-15x - 9y = -720$

$y = 5$

(10) cont: $\underline{\underline{\text{A breakfast costs £5}}}$

(1 night costs £45 – not required)

(Other strategies possible)

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(11) a) $8^{2/3} = \sqrt[3]{8^2} = \sqrt[3]{64} = \underline{\underline{4}}$

b) $\dfrac{\sqrt{24}}{\sqrt{2}} = \sqrt{\dfrac{24}{2}} = \sqrt{12} = \sqrt{4} \times \sqrt{3} = \underline{\underline{2\sqrt{3}}}$

(OR $\dfrac{\sqrt{12}\cancel{\sqrt{2}}}{\cancel{\sqrt{2}}} = \sqrt{12}$ etc)

c) $\dfrac{2x+2}{(x+1)^2} = \dfrac{2\cancel{(x+1)}}{(x+1)\cancel{(x+1)}} = \underline{\underline{\dfrac{2}{x+1}}}$

(Don't expand brackets – you're "undoing" factorisation)

PAPER C:2

(1) 12 noon $\rightarrow$ 5 pm = 5 h

$\Rightarrow 50000 \times (1{\cdot}046)^5$

$= 62607{:}\ldots = \underline{\underline{62\,600 \text{ (to 3 sig. fig)}}}$

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(2) Angle ($\angle$) PLJ = 43°

($\angle$PLN = 90° → tangent meets radius: 90 − 47 = 43)

$\angle$PLK = 59°

($\angle$PKL = 90° → angle in semi-circle: 180 − (90 + 31) = 59)

in ΔPKL

So $\angle$JLK = 43° + 59° $\underline{\underline{= 102°}}$

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(3) $y = ax^3 + c$ or $ax^3 + c = y$ $(-c)$

$ax^3 = y - c$

(3) cont.

$$ax^3 = y - c \quad (\div a)$$

$$x^3 = \frac{y-c}{a} \quad (\text{Take } \sqrt[3]{\ })$$

$$x = \sqrt[3]{\frac{y-c}{a}}$$

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(4) a) cylinder

$$V = \pi r^2 h \qquad r = 5\text{cm } (10 \div 2)$$

$$= \pi \times 5^2 \times 14 \qquad h = 14\text{cm}$$

$$= 1100\text{ cm}^3 \qquad (1099\text{cm}^3 \text{ if } \pi = 3{\cdot}14 \text{ used})$$

b)

$$V = \pi r^2 h \qquad V = 600$$

$$600 = \pi \times 5^2 \times h \qquad r = 5$$

$$h = ?$$

$$600 = 25\pi \times h \quad (\div 25\pi)$$

$$h = \frac{600}{25\pi}$$ use brackets on calculator

Depth $= 7{\cdot}64\text{cm}$

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(5) From $T \rightarrow P$ is 7 "moves" i.e. $\frac{7}{16}$ of circumference

$$C = \pi D \qquad D = 18 \quad (2 \times r = 2 \times 9)$$

$$\text{Arc length } TP = \frac{7 \times \pi \times 18}{16}$$

$$= 24{\cdot}7\text{ m}$$

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(6)

$$2x^2 + 4x - 9 \qquad a = 2$$

$$b = 4$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad c = -9$$

("to 1 dec. pl." → use formula : it won't factorise)

HSoG N5 Model Papers

(6) cont. $x = \dfrac{-4 \pm \sqrt{4^2 - 4 \times 2 \times (-9)}}{2 \times 2}$

$= \dfrac{-4 \pm \sqrt{16 - (-72)}}{4} = \dfrac{-4 \pm \sqrt{88}}{4}$

$\Rightarrow x = \dfrac{-4 + 9 \cdot 38}{4}$ or $\dfrac{-4 - 9 \cdot 38}{4} = 1 \cdot 345$ or $-3 \cdot 345$

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

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(7) Scale factor (sf) $= \frac{9}{6} = \frac{3}{2}$ (linear)

Sf (volume) $= \left(\frac{3}{2}\right)^3 = \frac{27}{8}$

So Volume (large bottle) $= \frac{27}{8} \times 30 = \underline{\underline{101 \cdot 25 \text{ ml}}}$

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

$(x-2)(x-2) - 5x = 0 \Rightarrow x^2 - 2x - 2x + 4 - 5x = 0$

$\Rightarrow x^2 - 9x + 4 = 0$

$a = 1$
$b = -9$
$c = 4$

(Calculate "discriminant")

$\sqrt{b^2 - 4ac}$

$= \sqrt{(-9)^2 - 4 \times 1 \times 4}$

$= \sqrt{81 - 16} = \sqrt{65}$

<u>Since disc > 0, there are 2 (distinct) real roots</u>

(No need to calculate roots, nor $\sqrt{65}$)

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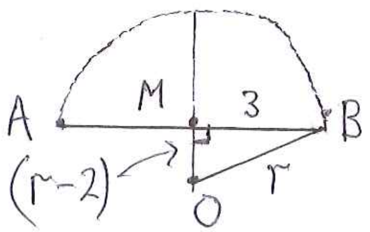
(9)



$OB = r$ and $OM = r - 2$

$AM = 3$ $(6 \div 2)$ so:

$r^2 = (r-2)^2 + 3^2$ (Pythagoras)

$r^2 = (r-2)(r-2) + 9$

(9) cont :

$$r^2 = r^2 - 2r - 2r + 4 + 9$$
$$\Rightarrow r^2 = r^2 - 4r + 13 \quad (-r^2)$$
$$\Rightarrow 0 = -4r + 13 \quad (+4r)$$
$$\Rightarrow 4r = 13 \quad (\div 4)$$
$$\Rightarrow r = \frac{13}{4} = 3{\cdot}25$$

So $\underline{\underline{OB = 3{\cdot}25\,m}}$

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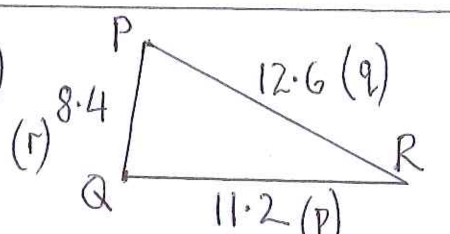
(10) a)



$$\cos\hat{Q} = \frac{p^2 + r^2 - q^2}{2pr} \quad \text{(Cosine Rule)}$$
$$= \frac{11{\cdot}2^2 + 8{\cdot}4^2 - 12{\cdot}6^2}{2 \times 11{\cdot}2 \times 8{\cdot}4} = \frac{37{\cdot}24}{188{\cdot}16}$$
$$= 0{\cdot}198 \quad \text{so } \hat{Q} = \cos^{-1} 0{\cdot}198$$
$$\Rightarrow \underline{\underline{\angle PQR(\hat{Q}) = 78{\cdot}6^\circ}}$$

b) $\text{Area}(\Delta PQR) = \frac{1}{2} pr \sin\hat{Q} = \frac{1}{2} \times 11{\cdot}2 \times 8{\cdot}4 \times \sin 78{\cdot}6^\circ$

$\text{Area}(\text{parm}) = 2 \times (\text{Area } \Delta PQR) = 2 \times \frac{1}{2} \times 11{\cdot}2 \times 8{\cdot}4 \times \sin 78{\cdot}6^\circ$

$= \underline{\underline{92{\cdot}22\,cm^2}}$

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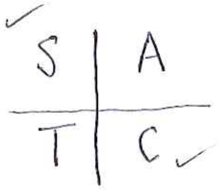
(11) a) $2\tan x^\circ + 7 = 0 \quad (-7)$

$\Rightarrow 2\tan x^\circ = -7 \quad (\div 2)$

$\Rightarrow \tan x^\circ = -3{\cdot}5 \longrightarrow$ Solve $\tan x^\circ = +3{\cdot}5$

$\Rightarrow x^\circ = 74{\cdot}1^\circ$ (Related acute angle)



x° is in Q2 or Q4 (since its tan is -ve)

Q2 : $180 - 74{\cdot}1 = 105{\cdot}9$

Q4 : $360 - 74{\cdot}1 = 285{\cdot}9$

So x° $\underline{\underline{= 105{\cdot}9^\circ \text{ or } 285{\cdot}9^\circ}}$

(11) b) Left side : $\sin^3 x + \sin x \cos^2 x$ (Common factor $= \sin x$)

$= \sin x(\sin^2 x + \cos^2 x)$ $=1$

$= \sin x \times 1$

$= \sin x$ (= Right side)

So $\sin^3 x + \sin x \cos^2 x = \sin x$ Proved

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(12) a) $T = \frac{D}{S} = \frac{x}{75}$ (hours)

b) Total $T = \frac{x}{75} + \frac{x}{50}$ (LCM of 75 and 50 $= 150$)

(from a)

$\downarrow \times 2 \quad \downarrow \times 3$

$\frac{2x}{150} + \frac{3x}{150} = \frac{5x}{150} \, (\div 5) = \frac{x}{30}$.

(Average) Speed $S = \frac{D}{T} = 2x \div \frac{x}{30}$ (Dist. A→B and B→A = $2x$)

(Change to X, invert 2nd fraction) $\longrightarrow$ $= \frac{2x}{1} \times \frac{30}{x}$

$= \frac{60\cancel{x}}{\cancel{x}} \, (\div x) = 60$

Average speed = 60km/h

Paper 1 HSoG N5 Paper D Solutions

① $m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$ (3, −7) (−5, 3)

$= \frac{3-(-7)}{-5-3}$

$= \frac{10}{-8}$

$= -\frac{5}{4}$.

② $\frac{2}{5}$ of $3\frac{1}{2} + \frac{4}{5}$

$= \frac{2}{5} \times 3\frac{1}{2} + \frac{4}{5}$

$= \frac{2}{5} \times \frac{7}{2} + \frac{4}{5}$

$= \frac{14}{10} + \frac{4}{5}$

$= \frac{70+40}{50} = \frac{110}{50} = \frac{11}{5} = 2\frac{1}{5}$.

③ A(−2, −3) B(4, 9)

$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9-(-3)}{4-(-2)} = \frac{12}{6} = 2$;

$y - b = m(x-a)$ pt(4, 9) m = 2.

$y - 9 = 2(x-4)$

$y - 9 = 2x - 8$

$y = 2x + 1$.

④ 37, 41, 43, 47, 56, 58, 59, 61, 66, 68, 70, 75

a) i) median (Q_2) = 58·5

ii) $Q_1 = \frac{43+47}{2} = \frac{90}{2} = 45$

$Q_3 = 67$

$SIQR = \frac{Q_3 - Q_1}{2} = \frac{67-45}{2} = \frac{22}{2} = 11$.

b)

median		SIQR	
	58·5		11
	67		7

- In general the average marks improved from October to December
- The marks were more consistent in December.

⑤ 112·5% of x = 450

non calc ∴ use 100% = 1, 12·5% = $\frac{1}{8}$

$1\frac{1}{8}$ of $x = 450$

$\frac{9}{8}x = 450$

$9x = 3600$

$x = 400$ ∴ Standard jar = 400g.

⑥ $\overrightarrow{RP} = \overrightarrow{RS} + \overrightarrow{ST} + \overrightarrow{TP}$

$= -g - f + h$

$= h - f - g$.

⑦ $y = (x+2)^2 - 16$

a) $\therefore$ min TP @ $(-2, -16)$ So $P = \underline{(-2,-16)}$.

b) $P_x \to R_x$ is $-2 \to 2 = 4$ units so $R_x \to Q_x$ also 4 units

$2 + 4 = 6$ $\therefore$ $\underline{Q(6,-16)}$.

c) $Q_x \to S_x$ is 8 units $\therefore$ $6 + 8 = 14$ $S\underline{(14,-16)}$.

So $\underline{y = (x-14)^2 - 16}$.

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⑧ $\dfrac{3}{m} + \dfrac{4}{m+1}$

$= \dfrac{3(m+1) + 4m}{m(m+1)}$

$= \dfrac{3m + 3 + 4m}{m(m+1)}$

$= \underline{\dfrac{7m+3}{m(m+1)}}$.

⑨ $a = \text{amplitude} = \underline{4}$.

$b = \dfrac{360}{120} = \underline{3}$.

⑩ $\cancel{2}^{0} + 3^{-1}$

$= 1 + \dfrac{1}{3}$

$= \underline{1\tfrac{1}{3}}$ $\left[\dfrac{4}{3}\right]$.

⑪ $\sqrt{12} + 5\sqrt{3} - \sqrt{27}$

$= \sqrt{4}\sqrt{3} + 5\sqrt{3} - \sqrt{9}\sqrt{3}$

$= 2\sqrt{3} + 5\sqrt{3} - 3\sqrt{3}$

$= \underline{4\sqrt{3}}$.

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⑫ $A_{circle} = \pi r^2$

$= \pi \times \left(\dfrac{5}{\pi}\right)^2$

$= \pi \times \dfrac{25}{\pi^2}$

$= \dfrac{25\cancel{\pi}}{\pi^{\cancel{2}}}$

$= \underline{\dfrac{25}{\pi}}$ proved.

$C = \pi d$

$\pi d = 10$

$d = \underline{\dfrac{10}{\pi}}$. $\therefore r = \dfrac{10}{\pi} \div 2$

$= \dfrac{10}{\pi} \times \dfrac{1}{2}$

$= \dfrac{10}{2\pi} = \underline{\dfrac{5}{\pi}}$.

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⑬ $y = ax + b$

$a < 0$ means $y = -x$ $\therefore$ -ve gradient

$b < 0$ means $-b$ $\therefore$ y intercept below x axis