Higher 2026 Paper 1

① $2x^2 + 20x + 3 = p(x+q)^2 + r$

$= p(x^2 + 2qx + q^2) + r$

$= px^2 + 2pqx + pq^2 + r$

$p = 2$ $\quad 2pq = 20$ $\quad pq^2 + r = 3$

$4q = 20 \quad 50 + r = 3$

$q = 5 \quad r = -47$

$\underline{\underline{2x^2 + 20x + 3 = 2(x+5)^2 - 47}}$

or

$2x^2 + 20x + 3$

$= 2[x^2 + 10x] + 3$

$= 2[(x+5)^2 - 25] + 3$

$= 2(x+5)^2 - 50 + 3$

$= \underline{2(x+5)^2 - 47}$

$\overline{3}$

---

② $\int (15x^{2/3} + 7x^{-2})\,dx$

$= \frac{15x^{5/3}\,3}{5} + \frac{7x^{-1}}{-1} + C$

$= \underline{\underline{9\sqrt[3]{x^5} - \frac{7}{x} + C}}$

$\overline{4}$

---

③ centre $(-1, 2)$ $\quad M_{rad} = \frac{6-2}{2--1} = \frac{4}{3}$ $\quad m_\perp = -\frac{3}{4}$

$6 = -\frac{3}{4}(2) + c$

$6 = -\frac{3}{2} + c$

$12 = -3 + 2c$

$c = \frac{15}{2}$

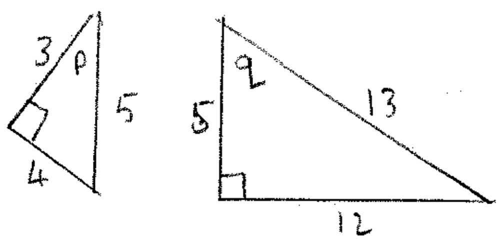
$\underline{y = -\frac{3}{4}x + \frac{15}{2}}$

or $\underline{\underline{4y = -3x + 30}}$

$\overline{4}$

---

④



$\sin p = \frac{4}{5} \quad \sin q = \frac{12}{13}$

$\cos p = \frac{3}{5} \quad \cos q = \frac{5}{13}$

(a) $\underline{\underline{\sin q = \frac{12}{13}}}$

(b)(i) $\sin(p+q) = \sin p \cos q + \cos p \sin q$

$= \frac{4}{5} \times \frac{5}{13} + \frac{3}{5} \times \frac{12}{13}$

$= \frac{20}{65} + \frac{36}{65}$

$= \underline{\underline{\frac{56}{65}}}$

$\overline{8}$

(ii) $\cos(p+q) = \cos p \cos q - \sin p \sin q$

$= \frac{3}{5} \times \frac{5}{13} - \frac{4}{5} \times \frac{12}{13}$

$= \frac{15}{65} - \frac{48}{65} = \underline{\underline{-\frac{33}{65}}}$

(c) $\tan(p+q) = \frac{\sin(p+q)}{\cos(p+q)}$

$= \frac{56}{65} \times -\frac{65}{33}$

$= \underline{\underline{-\frac{56}{33}}}$

5 (a)(i) $f(g(x)) = f(x+3)$
$= 2(x+3)^2 + 5$
$= 2(x^2+6x+9)+5$
$= 2x^2+12x+18+5$
$= \underline{2x^2+12x+23}$

(ii) $g(f(x)) = g(2x^2+5)$
$= 2x^2+5+3$
$= \underline{2x^2+8}$

4

(b) $\underline{g(f(x)) \geqslant 8}$

---

6 $\vec{MN} = \vec{MH} + \vec{HE} + \vec{EN}$

$= \underline{-\frac{1}{2}\underset{\sim}{u} - \underset{\sim}{v} + \frac{1}{3}\underset{\sim}{w}}$

2

---

7 $y = 2x + 4x^{1/2}$ $\quad \frac{dy}{dx} = 2 + 2x^{-1/2}$
$= 2 + \frac{2}{\sqrt{x}}$

when $x = 9$ $\frac{dy}{dx} = 2 + \frac{2}{\sqrt{9}}$
$= 2 + \frac{2}{3}$
$= \underline{\frac{8}{3}}$

4

---

8 $\log_2 x + \log_2(x+2) = 3$
$\log_2 x(x+2) = 3$
$x^2 + 2x = 2^3$

$x^2 + 2x - 8 = 0$
$(x-2)(x+4) = 0$
$\underline{x = 2}$ $\quad \cancel{x = -4}$

4

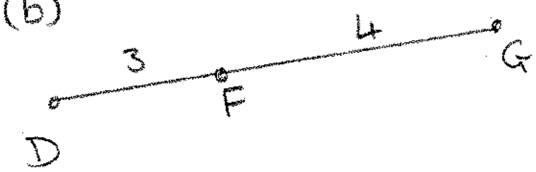
---

9 a) $\vec{DE} = \underset{\sim}{e} - \underset{\sim}{d}$
$= \begin{pmatrix} 1 \\ 2 \\ 7 \end{pmatrix} - \begin{pmatrix} -1 \\ 6 \\ 1 \end{pmatrix}$
$= \begin{pmatrix} 2 \\ -4 \\ 6 \end{pmatrix} = 2\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$

$\vec{EF} = \underset{\sim}{f} - \underset{\sim}{e}$
$= \begin{pmatrix} 2 \\ 0 \\ 10 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ 7 \end{pmatrix}$
$= \begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix}$

$2\vec{EF} = \vec{DE}$ $\therefore$ EF & DE are parallel. Since there is a common point E, D, E & F are collinear.

(b)



$4\vec{DF} = 3\vec{FG}$
$4(\underset{\sim}{f} - \underset{\sim}{d}) = 3(\underset{\sim}{g} - \underset{\sim}{f})$
$4\underset{\sim}{f} - 4\underset{\sim}{d} = 3\underset{\sim}{g} - 3\underset{\sim}{f}$

$3\underset{\sim}{g} = 7\underset{\sim}{f} - 4\underset{\sim}{d}$

$\underset{\sim}{g} = \frac{1}{3}(7\underset{\sim}{f} - 4\underset{\sim}{d})$

$= \frac{1}{3}\left[7\begin{pmatrix} 2 \\ 0 \\ 10 \end{pmatrix} - 4\begin{pmatrix} -1 \\ 6 \\ 1 \end{pmatrix}\right]$

$= \frac{1}{3}\begin{pmatrix} 18 \\ -24 \\ 66 \end{pmatrix} = \begin{pmatrix} 6 \\ -8 \\ 22 \end{pmatrix}$

$\underline{G\ (6, -8, 22)}$

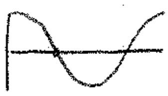
5

(10) $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} 6\sin\left(3x-\frac{\pi}{2}\right)dx$

$= \left[-\frac{6}{3}\cos\left(3x-\frac{\pi}{2}\right)\right]_{\pi/6}^{\pi/3}$

$= \left(-2\cos\left(\frac{3\pi}{3}-\frac{\pi}{2}\right)\right)-\left(-2\cos\left(3\frac{\pi}{6}-\frac{\pi}{2}\right)\right)$

$= -2\cos\frac{\pi}{2} + 2\cos 0$



$= \underline{\underline{2}}$

$\overline{4}$

---

(11)(a)(i) $x+2=0$, $x=-2$

$x=-2$	1	7	18	16
	↓	−2	−10	−16
	1	5	8	$\boxed{0}$

Remainder $=0$ $\therefore$ $x+2$ is a factor.

(ii) $x^3+7x^2+18x+16$
$=(x+2)(x^2+5x+8)$

linear factor — quadratic factor

$\Delta = b^2-4ac$
$= 25-32$
$= -7$ not a square number so does not factorise, so $(x+2)$ is the only linear factor.

(b) $2x^3+20x^2+27x+9 = 6x^2-9x-23$
$2x^3+26x^2+36x+32=0$
$(x+2)(x^2+5x+8)=0$

$x=-2$ — No real solutions

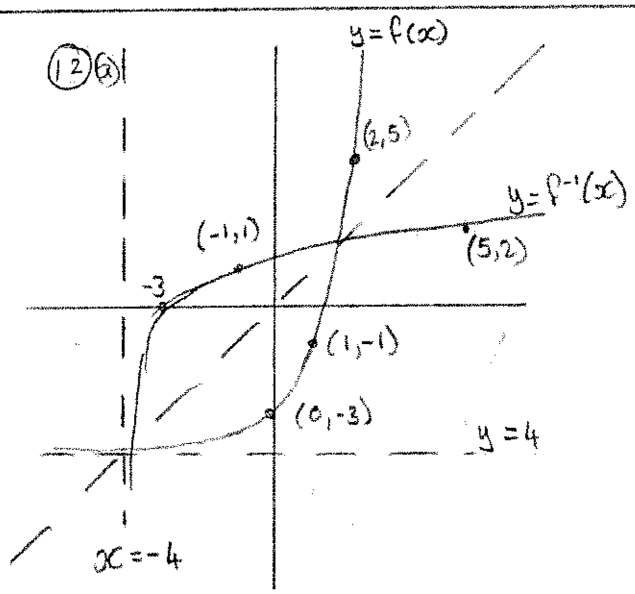
$\overline{8}$

When $x=-2$, $y = 6(-2)^2-9(-2)-23$
$= 24+18-23$
$= 19$

P.O.I. $\underline{(-2,19)}$

---

(12)(a)



(b)(i) $y=\log_a(x+b)$

Sub $(-3,0)$: $0=\log_a(-3+b)$
$1=-3+b$
$\underline{\underline{b=4}}$

Sub $(5,2)$: $2=\log_a(5+4)$
$2=\log_a 9$
$a^2=9$
$\underline{\underline{a=3}}$

(ii) $\underline{\underline{x>-4}}$

$\overline{5}$