HIGHER MATHS 2025

Paper 1

(1) $y = 2^3 - 2(2)^2 + 5$

$= 8 - 8 + 5$

$= 5 \quad \therefore (2, 5)$

$\frac{dy}{dx} = 3x^2 - 4x$

$\therefore m = 3(2)^2 - 4(2)$

$= 12 - 8$

$= 4$

$y - 5 = 4(x - 2)$

$y - 5 = 4x - 8$

$\underline{\underline{y = 4x - 3}}$

(2) $\text{mid} = \left(\frac{1+9}{2}, \frac{4+10}{2}\right)$

$= (5, 7)$

$m_{AB} = \frac{10-4}{9-1}$

$= \frac{6}{8}$

$= \frac{3}{4}$

$\therefore m_{PB} = -\frac{4}{3}$

$y - 7 = -\frac{4}{3}(x - 5)$

$3y - 21 = -4x + 20$

$\underline{\underline{3y = -4x + 41}}$

(3) $\int (12x^{-2} + x^{1/2})\,dx$

$= \frac{12x^{-1}}{-1} + \frac{x^{3/2}}{\frac{3}{2}} + C$

$= \underline{-12x^{-1} + \frac{2}{3}x^{3/2} + C}$

(4) $3\log_3 2 + \log_3 \frac{1}{24}$

$= \log_3 2^3 + \log_3 \frac{1}{24}$

$= \log_3 8 + \log_3 \frac{1}{24}$

$= \log_3 \frac{8}{24}$

$= \log_3 \frac{1}{3}$

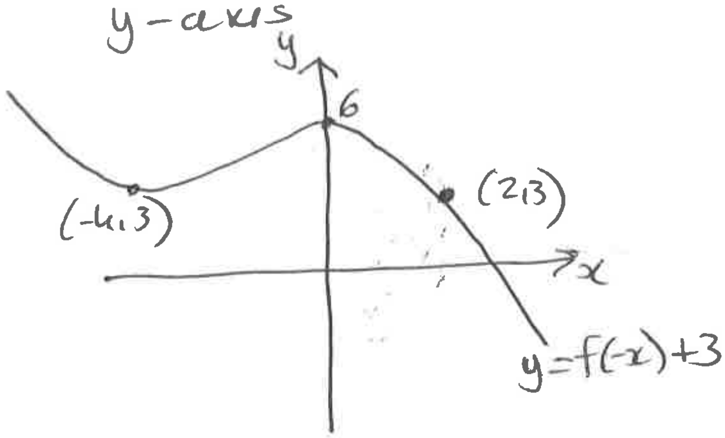
$= \log_3 (3^{-1})$

$= \underline{\underline{-1}}$

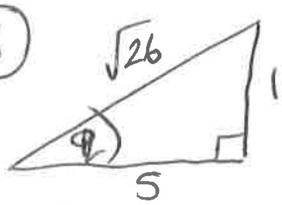
(5) $y = f(-x) + 3$

Flip in y-axis

+3 vertically



(6)



$h^2 = 5^2 + 1^2$

$= 26$

$h = \sqrt{26}$

a) (i) $\sin 2q = 2\sin q \cos q$

$= 2\left(\frac{1}{\sqrt{26}}\right)\left(\frac{5}{\sqrt{26}}\right)$

$= \frac{10}{26}$

$= \underline{\underline{\frac{5}{13}}}$

(ii) $\cos 2q = \cos^2 q - \sin^2 q$

$= \left(\frac{5}{\sqrt{26}}\right)^2 - \left(\frac{1}{\sqrt{26}}\right)^2$

$= \frac{25}{26} - \frac{1}{26}$

$= \frac{24}{26} = \underline{\underline{\frac{12}{13}}}$

b) $\sin(2q - r)$

$= \sin 2q \cos r - \cos 2q \sin r$

$= \left(\frac{5}{13} \times \frac{4}{\sqrt{17}}\right) - \left(\frac{12}{13} \times \frac{1}{\sqrt{17}}\right)$

$= \frac{20}{13\sqrt{17}} - \frac{12}{13\sqrt{17}}$

$= \frac{8}{13\sqrt{17}}$

7 a) let $f(x) = 5x^3 + 16x^2 - x - 12$

$f(-3) = 5(-3)^3 + 16(-3)^2 - (-3) - 12$

$= 5(-27) + 16(9) + 3 - 12$

$= -135 + 144 - 9$

$= 0$

$\therefore x = -3$ is a root

$(x+3)$ is a factor

b)

	$5x^2$	$+x$	-4
x	$5x^3$	$+x^2$	$-4x$
$+3$	$+15x^2$	$+3x$	-12

$\therefore f(x) = (x+3)(5x^2 + x - 4)$

	$5x$	-4
x	$5x^2$	$-4x$
$+1$	$+5x$	-4

20

1 20

2 10

4 5

$\therefore F(x) = (x+3)(x+1)(5x-4)$

8 $\log_a 75 = 2 + \log_a 3$

$\log_a 75 - \log_a 3 = 2$

$\log_a 25 = 2$

$25 = a^2$

$a = \sqrt{25}$

$a = \cancel{-5}, 5$

$\therefore a = 5$

9

$x^2 + (x+1)^2 - 2x + 6(x+1) - 15 = 0$

$x^2 + x^2 + 2x + 1 - 2x + 6x + 6 - 15 = 0$

$2x^2 + 6x - 8 = 0$

$2(x^2 + 3x - 4) = 0$

$2(x+4)(x-1) = 0$

$x = -4 \quad x = 1$

$y = -3 \quad y = 2$

$\therefore (-4, -3) \quad (1, 2)$

10 $\underline{u} \cdot \underline{v}$

$= (1 \times 1) + (1 \times 3) + (0 \times k)$

$= 1 + 3 + 0$

$= 4$

$|\underline{u}| = \sqrt{1^2 + 1^2 + 0^2}$

$= \sqrt{2}$

$|\underline{v}| = \sqrt{1^2 + 3^2 + k^2}$

$= \sqrt{k^2 + 10}$

11. $a = 9 \quad b = 3k \quad c = k$

For real, distinct roots

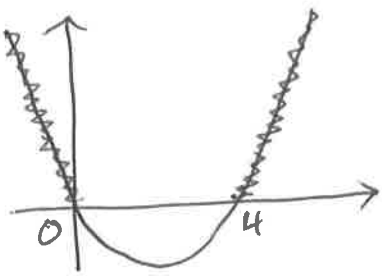
$$b^2 - 4ac > 0$$

$$\therefore (3k)^2 - 4(9)(k) > 0$$

$$9k^2 - 36k > 0$$

$$9k(k-4) > 0$$

roots @ $k = 0$, $k = 4$



$$\therefore \underline{k < 0, \ k > 4}$$

12. $y = \int (6\cos x + 8\sin 2x)\,dx$

$$= 6\sin x - \frac{8}{2}\cos 2x + C$$

$$= 6\sin x - 4\cos 2x + C$$

$$\therefore 6\sin\left(\frac{\pi}{6}\right) - 4\cos 2\left(\frac{\pi}{6}\right) + C = 4$$

$$6\sin 30^\circ - 4\cos 60^\circ + C = 4$$

$$6\left(\tfrac{1}{2}\right) - 4\left(\tfrac{1}{2}\right) + C = 4$$

$$3 - 2 + C = 4$$

$$C + 1 = 4$$

$$\underline{C = 3}$$

$$\therefore \underline{y = 6\sin x - 4\cos 2x + 3}$$

13. a) SP's @ $f'(x) = 0$

$$\therefore (x+5)(2-x) = 0$$

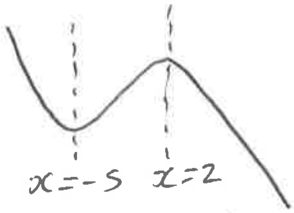
$$x = -5 \quad x = 2$$

x	$\xrightarrow{-6}$	-5	$\xrightarrow{0}$	$\xrightarrow{0}$	2	$\xrightarrow{3}$
$f'(x)$	$-$	0	$+$	$+$	0	$-$
shape	\	—	/	/	—	\

$\therefore$ Min TP @ $x = -5$

Max TP @ $x = 2$

b) From a): shape is



- $f(0) < 0 \rightarrow$ y-intercept is negative.
- $f(x) = 0$ one solution $\rightarrow$ one root, between -10 and 10.

y-axis must be between the min and max TP.

Since only one root, the Max TP must be below the x-axis.