QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

1.(a)

$$m_{QR} = \frac{3-8}{13+2}$$

$$= \frac{-5}{15}$$

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

$$m_{alt} = 3$$

$$y + 1 = 3(x-5)$$

$$y + 1 = 3x - 15$$

$$y = 3x - 16$$

1.(b)

$$m_{PR} = \frac{3+1}{13-5}$$

$$= \frac{4}{8}$$

$$= \frac{1}{2}$$

$$\tan\theta = \frac{1}{2}$$

$$\theta = 26.6^\circ$$

QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

2.

$y = 2x^5 - 3x$

$\frac{dy}{dx} = 10x^4 - 3$

$m = 10(1)^4 - 3$

$m = 7$

$x = 1$

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

$y = -1$

$(1, -1)$

$y + 1 = 7(x - 1)$

$y + 1 = 7x - 7$

$y = 7x - 8$

3.

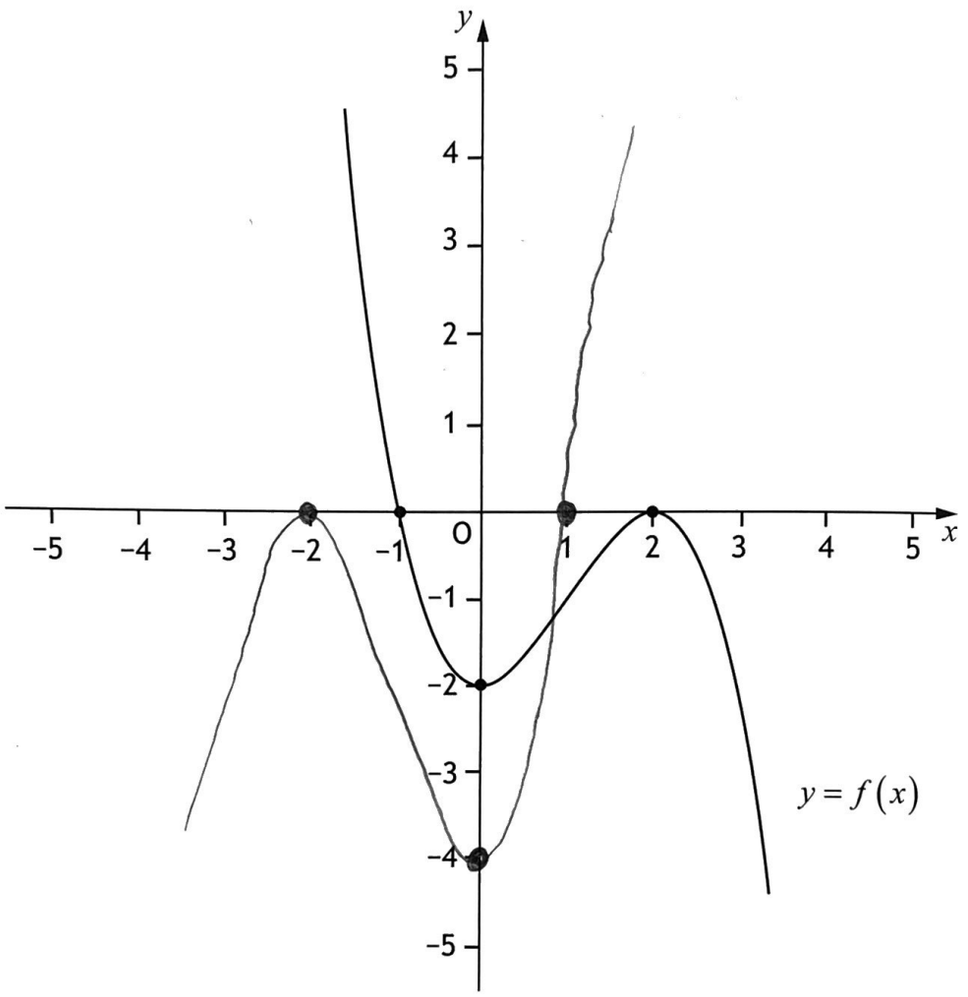
$\int 7\cos\left(4x + \frac{\pi}{3}\right) dx$

$= \frac{7}{4}\cos\left(4x + \frac{\pi}{3}\right) + C$

QUESTION NUMBER

4.

An additional diagram, if required, can be found on *page 16*.



$f(x)$	$f(-x)$	$2f(-x)$
$(-1, 0)$	$(1, 0)$	$(1, 0)$
$(0, -2)$	$(0, -2)$	$(0, -4)$
$(2, 0)$	$(-2, 0)$	$(-2, 0)$

DO NOT WRITE IN THIS MARGIN

QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

5.

$$f(x) = (3-2x)^4$$

$$f'(x) = 4(3-2x)^3 \times (-2)$$

$$f'(1) = 4(3-2(4))^3 \times (-2)$$

$$= 4(-5)^3 \times (-2)$$

$$= 1000$$

6.

$$f(f^{-1}(x)) = x$$

$$\frac{2}{f^{-1}(x)} + 3 = x$$

$$\frac{2}{f^{-1}(x)} = x - 3$$

$$f^{-1}(x) = \frac{2}{x-3}$$

QUESTION NUMBER

7.

$\sin x + 2 = 3\cos 2x$

$\sin x + 2 = 3(1 - 2\sin^2 x)$

$\sin x + 2 = 3 - 6\sin^2 x$

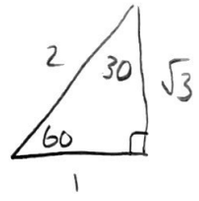
$6\sin^2 x + \sin x - 1 = 0$

$(3\sin x - 1)(2\sin x + 1) = 0$

$3\sin x - 1 = 0 \qquad 2\sin x + 1 = 0$

$\sin x = \frac{1}{3} \qquad \sin x = -\frac{1}{2}$

$x = 19.5°; 160.5° \qquad x = 210°, 330°$



$\sin^{-1}\left(\frac{1}{2}\right) = 30°$

S	A
T ✓	C ✓

DO NOT WRITE IN THIS MARGIN

QUESTION NUMBER

8.

DO NOT WRITE IN THIS MARGIN

$$\int_{-2}^{1} (x^3 - 2x^2 - 4x + 1) - (x - 5)\, dx$$

$$= \int_{-2}^{1} x^3 - 2x^2 - 5x + 6\, dx$$

$$= \left[\frac{x^4}{4} - \frac{2x^3}{3} - \frac{5x^2}{2} + 6x \right]_{-2}^{1}$$

$$= \left[\frac{1^4}{4} - \frac{2(1)^3}{3} - \frac{5(1)^2}{2} + 6(1) \right] - \left[\frac{(-2)^4}{4} - \frac{2(-2)^3}{3} - \frac{5(-2)^2}{2} + 6(-2) \right]$$

$$= \frac{37}{12} - \left(-\frac{38}{3} \right)$$

$$= \frac{63}{4} \text{ square units.}$$

QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

9.(a)

$k\sin(x+a) = k\sin x\cos a + k\cos x\sin a$

$= k\cos a\sin x + k\sin a\cos x$

$= k\sin a\cos x + k\cos a\sin x$

$7\cos x - 3\sin x$

$k\sin a = 7$

$k\cos a = -3$

$k = \sqrt{7^2+3^2}$

$k = \sqrt{58}$

$\tan a = \frac{7}{-3}$

$a = 113$

S ✓✓	A ✓
T ✓	C

$\tan^{-1}(a) = 67$

$7\cos x - 3\sin x = \sqrt{58}\sin(x+113)^\circ$

9.(b) (i)

$14\cos x - 6\sin x$

$= 2(7\cos x - 3\sin x)$

$= 2\sqrt{58}\sin(x+113)^\circ$

Max value $= 2\sqrt{58}$

9.(b) (ii)

$x + 113 = 90, 450$

$x = 337^\circ$

$0 \leq x < 360$

$113 \leq x+113 < 473$

QUESTION NUMBER

10.

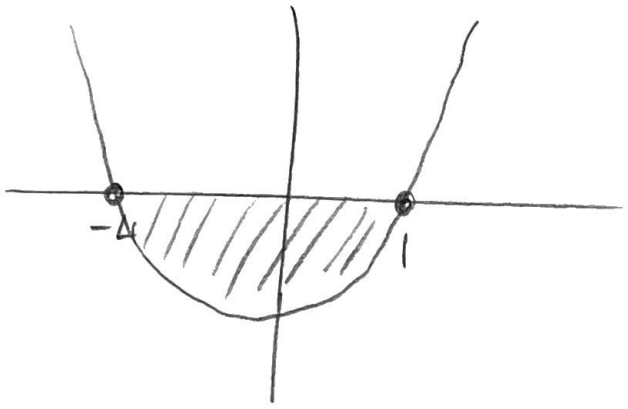
DO NOT WRITE IN THIS MARGIN

$f'(x) = 6x^2 + 18x - 24$

$6x^2 + 18x - 24 < 0$

$x^2 + 3x - 4 < 0$

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



$-4 < x < 1.$

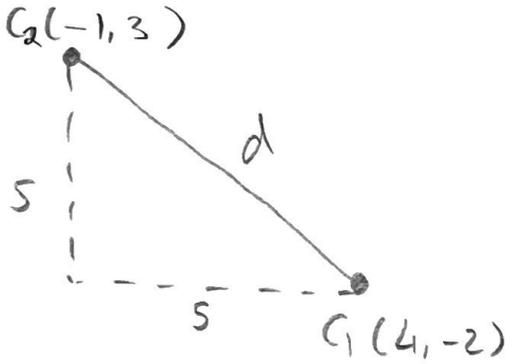
QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

11.(a)

$C_1(4, -2)$

$C_2(-1, 3)$



$d = \sqrt{5^2 + 5^2}$

$d = \sqrt{50}$

$d = 5\sqrt{2}$

11.(b)

$r_1 = \sqrt{37}$ $\quad r_2 = \sqrt{1^2 + (-3)^2 + 7}$

$r_2 = \sqrt{17}$

$r_1 + r_2 = 10.2$

$d = 7.1$

since $d < r_1 + r_2$, the circles intersect at two distinct points.

QUESTION NUMBER

12.

DO NOT WRITE IN THIS MARGIN

$$\frac{dy}{dx} = 8x^3 + 3$$

$$y = 2x^4 + 3x + c$$

$$3 = 2(-1)^4 + 3(-1) + c$$

$$3 = 2 - 3 + c$$

$$c = 4$$

$$y = 2x^4 + 3x + 4.$$

QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

13.(a)

$C_{30} = 11e^{-0.0053 \times 30}$

$= 9.38$

13.(b)

$0.66 = 11e^{-0.0053t}$

$0.06 = e^{-0.0053t}$

$-0.0053t = \ln 0.06$

$t = \dfrac{\ln 0.06}{-0.0053}$

$t = 530.83$ minutes

QUESTION NUMBER

DO NOT WRITE IN THIS MARGIN

14.(a) (i)

$$A = 6x^2 + 2xh + 3xh + 2xh + 3xh$$

$$A = 6x^2 + 10xh$$

14.(a) (ii)

$$7200 = 6x^2 + 10xh$$

$$h = \frac{7200 - 6x^2}{10x}$$

$$V = (3x)(2x)\left(\frac{7200 - 6x^2}{10x}\right)$$

$$V = 6x^2\left(\frac{7200 - 6x^2}{10x}\right)$$

$$V = 4320x - \frac{18}{5}x^3 \text{ as req'd.}$$

QUESTION NUMBER

14.(b)

DO NOT WRITE IN THIS MARGIN

$$V(x) = 4320x - \frac{18}{5}x^3$$

$$V'(x) = 4320 - \frac{54}{5}x^2$$

$$4320 - \frac{54}{5}x^2 = 0$$

$$\frac{54}{5}x^2 = 4320$$

$$x^2 = 400$$

$$x = \pm 20 \longrightarrow x = 20$$

	10 →	20	30 →
$V'(x)$	+	0	−
shape	↗	→	↘

Max when $x = 20$

QUESTION NUMBER

15.

DO NOT WRITE IN THIS MARGIN

$$x + 3y = 17$$

$$3y = -x + 17$$

$$y = \frac{-1}{3}x + \frac{17}{3}$$

$$m_{tangent} = -\frac{1}{3}$$

$$m_{radius} = 3$$

$$y - 5 = 3(x - 2)$$

$$y - 5 = 3x - 6$$

$$y = 3x - 1$$

since centre lies on y axis, centre is y intercept of the equation of the radius

$$C\ (0, -1)$$