C2, IYGB, PAPER C

1. a) $(2+x)^9 = \binom{9}{0}(2)^9(x)^0 + \binom{9}{1}(2)^8(x)^1 + \binom{9}{2}(2)^7(x)^2 + \binom{9}{3}(2)^6(x)^3 + \dots$

$= [1\times 512\times 1] + [9\times 256x] + [36\times 128x^2] + [84\times 64x^3] + \dots$

$= 512 + 2304x + 4608x^2 + 5376x^3 + \dots$

b) $(1-\frac{1}{8}x)^2(2+x)^9$

$= (1 - \frac{1}{4}x + \frac{1}{64}x^2)(512 + 2304x + 4608x^2 + 5376x^3 + \dots)$

$+36x^3$

$-1152x^3$

$5376x^3$

$\therefore 36 - 1152 + 5376 = 4260$

2.

x	1	2.25	3.5	4.75	6
y	9	17	25	21	13

FIRST ⟵ R E S T ⟶ LAST

$\int_1^6 f(x)\,dx = \frac{\text{THICKNESS}}{2}\left[\text{FIRST} + \text{LAST} + 2\times \text{REST}\right]$

$= \frac{1.25}{2}\left[9 + 13 + 2(17+25+21)\right]$

$= 92.5$

3. a) $f(x) = 3x^3 - 2x^2 - 12x + 8$

$f(4) = 192 - 32 - 48 + 8$

$f(4) = 120$

$\therefore$ REMAINDER IS 120

C2, IYGB, PAPER C

b)

$$
\begin{array}{r|l}
 & 3x^2+4x-4 \\
\hline
x-2 & 3x^3-2x^2-12x+8 \\
 & -3x^3+6x^2 \\
\hline
 & 4x^2-12x+8 \\
 & -4x^2+8x \\
\hline
 & -4x+8 \\
 & 4x-8 \\
\hline
 & 0
\end{array}
$$

$\therefore f(x)=0$

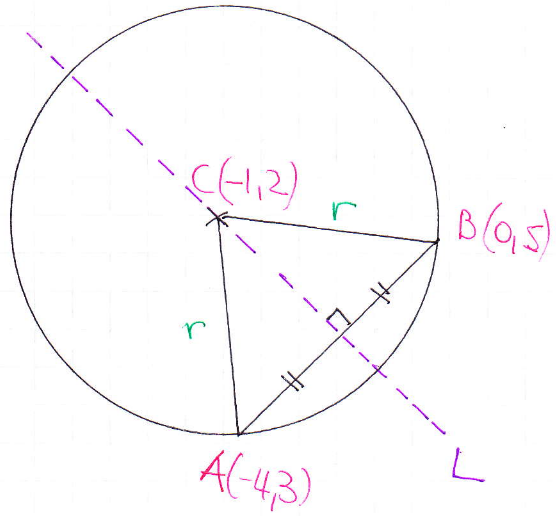
$3x^3+4x-4=0$

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

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

$\therefore x = 2, \ \frac{2}{3}, \ -2$

4. a)



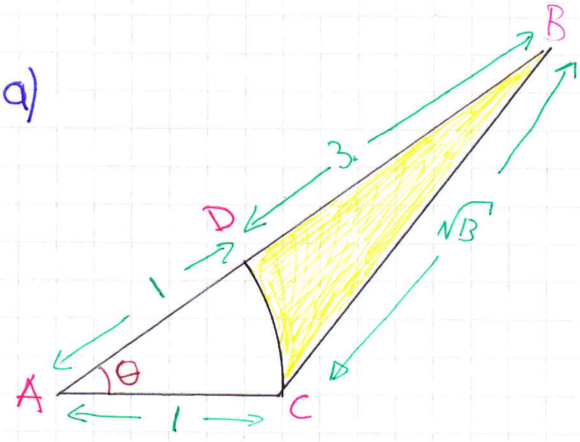
- DISTANCE $|BC| = \sqrt{(5-2)^2+(0+1)^2}$
$= \sqrt{9+1}$
$= \sqrt{10}$

- EQUATION OF CIRCLE
$(x+1)^2+(y-2)^2 = 10$

b)
- MIDPOINT OF AB $= \left(\frac{-4+0}{2}, \frac{5+3}{2}\right) = (-2,4)$
- GRADIENT AB $= \frac{y_2-y_1}{x_2-x_1} = \frac{5-3}{0+4} = \frac{1}{2}$
- GRADIENT OF L IS -2
- $y-y_0 = m(x-x_0)$
$y-4 = -2(x+2)$
$y-4 = -2x-4$
$y = -2x$

C2, IYGB, PAPER C

5. a)



BY THE COSINE RULE

$|BC|^2 = |AC|^2 + |AB|^2 - 2|AC||AB|\cos\theta$

$\sqrt{13}^2 = 1^2 + 4^2 - 2 \times 1 \times 4 \cos\theta$

$13 = 17 - 8\cos\theta$

$8\cos\theta = 4$

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

$\theta = \frac{\pi}{3}$

b) AREA OF SECTOR $\overset{\triangledown}{ACD} = \frac{1}{2}r^2\theta^c = \frac{1}{2} \times 1^2 \times \frac{\pi}{3} = \frac{\pi}{6}$

AREA OF TRIANGLE $= \frac{1}{2}|AB||AC|\sin\frac{\pi}{3} = \frac{1}{2} \times 4 \times 1 \times \sin\frac{\pi}{3} = \sqrt{3}$

REQUIRED AREA $= \sqrt{3} - \frac{\pi}{6} \approx 1.21$

6. $2\log_a x = \log_a 18 + \log_a (x-4)$

$\Rightarrow \log_a x^2 = \log_a [18(x-4)]$

$\Rightarrow x^2 = 18(x-4)$

$\Rightarrow x^2 - 18x + 72 = 0$

$\Rightarrow (x-6)(x-12) = 0$

$x = \begin{cases} 6 \\ 12 \end{cases}$

BOTH O.K

C2, IYGB, PAPER C

7. a) $f(x) = -x^3 + 9x^2 - 15x - 13$

$f'(x) = -3x^2 + 18x - 15$

SOLVE FOR ZERO

$-3x^2 + 18x - 15 = 0$

$3x^2 - 18x + 15 = 0$

$x^2 - 6x + 5 = 0$

$(x-1)(x-5) = 0$

$x = \begin{cases} 1 \\ 5 \end{cases} \quad y = \begin{cases} -20 \\ 12 \end{cases}$

$\therefore (1,-20) \quad (5,12)$

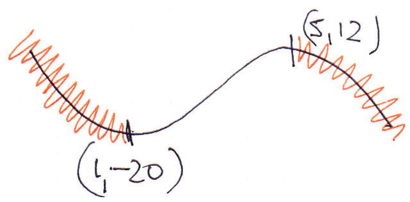
b) $f''(x) = -6x + 18$

$f''(1) = +12 > 0$

$\therefore (1,-20)$ IS A LOCAL MIN

$f''(5) = -12 < 0$

$(5,12)$ IS A LOCAL MAX

c) 

$\therefore x < 1$ OR $x > 5$

8. $\sin 3x = \sin 48°$

$\begin{cases} 3x = 48° \pm 360n \\ 3x = 132° \pm 360n \end{cases}$ $n = 0, 1, 2, 3, \ldots$

$\begin{cases} x = 16° \pm 120n \\ x = 44° \pm 120n \end{cases}$

$x_1 = 16°$

$x_2 = 136°$

$x_3 = 44°$

$x_4 = 164°$

C2, IYGB, PAPER C

9 a) $a = 5$, $r = 1.02$

- $u_n = ar^{n-1}$

$u_{10} = 5 \times 1.02^9$

$u_{10} = 5.975$

- $S_n = \frac{a(1-r^n)}{1-r}$

$S_{10} = \frac{5(1-1.02^{10})}{1-1.02}$

$S_{10} \simeq 54.749$

b) $S_n \leqslant 360$

$\Rightarrow \frac{5(1-1.02^n)}{1-1.02} \leqslant 360$

$\Rightarrow -250(1-1.02^n) \leqslant 360$

$\Rightarrow 1-1.02^n \geqslant -1.44$

$\Rightarrow -1.02^n \geqslant -2.44$

$\Rightarrow 1.02^n \leqslant 2.44$

AS REQUIRED

c) $1.02^n \leqslant 2.44$

$\Rightarrow \log(1.02^n) \leqslant \log 2.44$

$\Rightarrow n\log(1.02) \leqslant \log 2.44$

$\Rightarrow n \leqslant \frac{\log(2.44)}{\log(1.02)}$

$\Rightarrow n \leqslant 45.044\ldots$

$\therefore$ 45 JOURNEYS

10. FIRSTLY FIND THE COORDINATES OF P

$-x^2+11x-24 = 4$

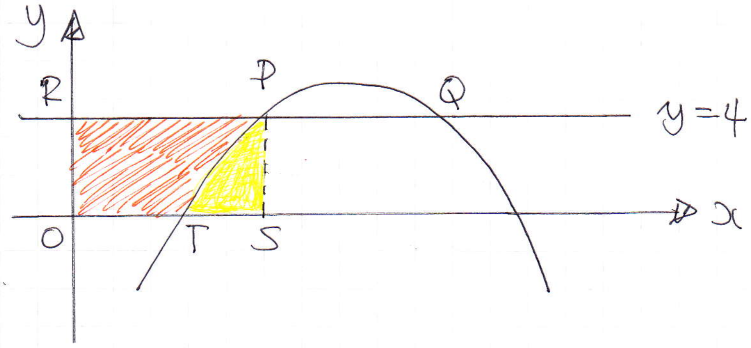
$0 = x^2-11x-28$

$0 = (x-7)(x-4)$

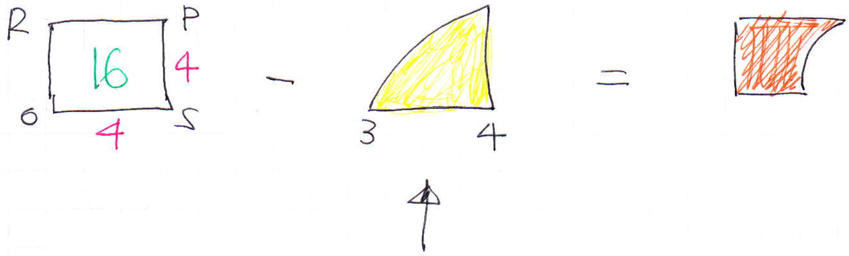
$x = 4, 7$ $\therefore$ $P(4,4)$

(P.T.O)

C2, IYGB, PAPER C



$$-x^2+11x-24=0$$
$$x^2-11x+24=0$$
$$(x-3)(x-8)=0$$
$$x = \begin{cases} 3 \leftarrow T \\ 8 \end{cases}$$



$$\int_3^4 -x^2+11x-24\,dx$$

$$= \left[-\frac{1}{3}x^3+\frac{11}{2}x^2-24x\right]_3^4$$

$$= \left(-\frac{64}{3}+88-96\right)-\left(-9+\frac{99}{2}-72\right)$$

$$= -\frac{88}{3}-\left(-\frac{63}{2}\right)$$

$$= \frac{13}{6}$$

$\therefore$ REQUIRED AREA $= 16-\frac{13}{6} = \frac{83}{6}$