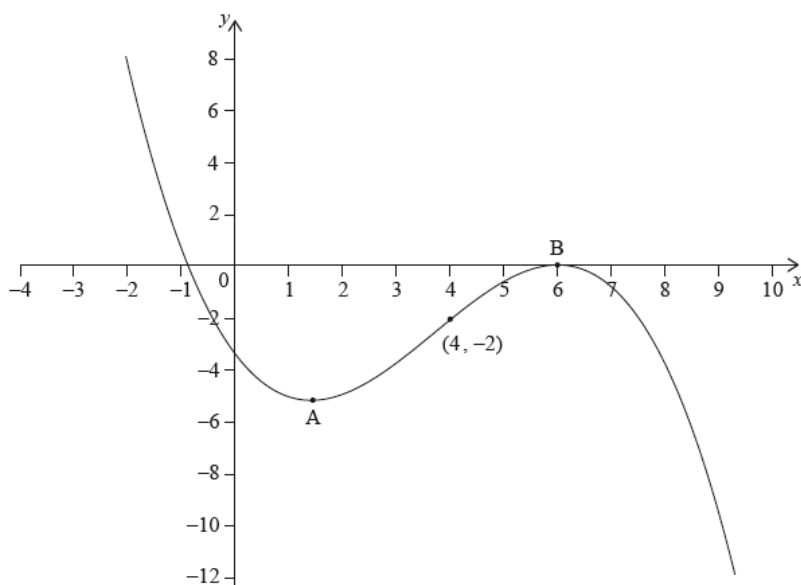


0202HW_Calculus_review [80 marks]

The following diagram shows the graph of f' , the derivative of f .



The graph of f' has a local minimum at A, a local maximum at B and passes through $(4, -2)$.

The point $P(4, 3)$ lies on the graph of the function, f .

1a. Write down the gradient of the curve of f at P. [1 mark]

1b. Find the equation of the normal to the curve of f at P. [3 marks]

1c. Determine the concavity of the graph of f when $4 < x < 5$ and justify your answer. [2 marks]

A quadratic function f can be written in the form $f(x) = a(x - p)(x - 3)$. The graph of f has axis of symmetry $x = 2.5$ and y -intercept at $(0, -6)$.

2a. Find the value of p . [3 marks]

2b. Find the value of a . [3 marks]

2c. The line $y = kx - 5$ is a tangent to the curve of f . Find the values of k . [8 marks]

The values of the functions f and g and their derivatives for $x = 1$ and $x = 8$ are shown in the following table.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	2	4	9	-3
8	4	-3	2	5

Let $h(x) = f(x)g(x)$.

3a. Find $h(1)$. [2 marks]

3b. Find $h'(8)$. [3 marks]

4. Let $f(x) = (x^2 + 3)^7$. Find the term in x^5 in the expansion of the derivative, $f'(x)$. [7 marks]

- 5a. Let \mathbf{u} [3 marks]

$$= \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix} \text{ and } \mathbf{w} = \begin{pmatrix} 3 \\ -1 \\ p \end{pmatrix}. \text{ Given that } \mathbf{u} \text{ is perpendicular to } \mathbf{w}, \text{ find the value of } p.$$

- 5b. Let [3 marks]

$$\mathbf{v} = \begin{pmatrix} 1 \\ q \\ 5 \end{pmatrix}. \text{ Given that } |\mathbf{v}| = \sqrt{42}, \text{ find the possible values of } q.$$

The vertices of the triangle PQR are defined by the position vectors

$$\begin{aligned} \overrightarrow{OP} &= \begin{pmatrix} 4 \\ -3 \\ 1 \end{pmatrix}, \\ \overrightarrow{OQ} &= \begin{pmatrix} 3 \\ -1 \\ 2 \end{pmatrix} \text{ and} \\ \overrightarrow{OR} &= \begin{pmatrix} 6 \\ -1 \\ 5 \end{pmatrix}. \end{aligned}$$

- 6a. Find [3 marks]

$$\begin{aligned} \text{(i)} \quad & \overrightarrow{PQ}; \\ \text{(ii)} \quad & \overrightarrow{PR}. \end{aligned}$$

- 6b. Show that $\cos \widehat{RPQ} = \frac{1}{2}$. [7 marks]

- 6c. (i) Find $\sin \widehat{RPQ}$. [6 marks]
(ii) Hence, find the area of triangle PQR, giving your answer in the form $a\sqrt{3}$.

The following table shows the average number of hours per day spent watching television by seven mothers and each mother's youngest child.

Hours per day that a mother watches television (x)	2.5	3.0	3.2	3.3	4.0	4.5	5.8
Hours per day that her child watches television (y)	1.8	2.2	2.6	2.5	3.0	3.2	3.5

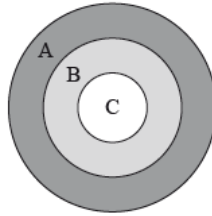
The relationship can be modelled by the regression line with equation $y = ax + b$.

- 7a. (i) Find the correlation coefficient. [4 marks]
(ii) Write down the value of a and of b .

- 7b. Elizabeth watches television for an average of 3.7 hours per day. [3 marks]

Use your regression line to predict the average number of hours of television watched per day by Elizabeth's youngest child. Give your answer correct to one decimal place.

The following diagram shows a board which is divided into three regions A , B and C .



A game consists of a contestant throwing one dart at the board. The probability of hitting each region is given in the following table.

Region	A	B	C
Probability	$\frac{5}{20}$	$\frac{4}{20}$	$\frac{1}{20}$

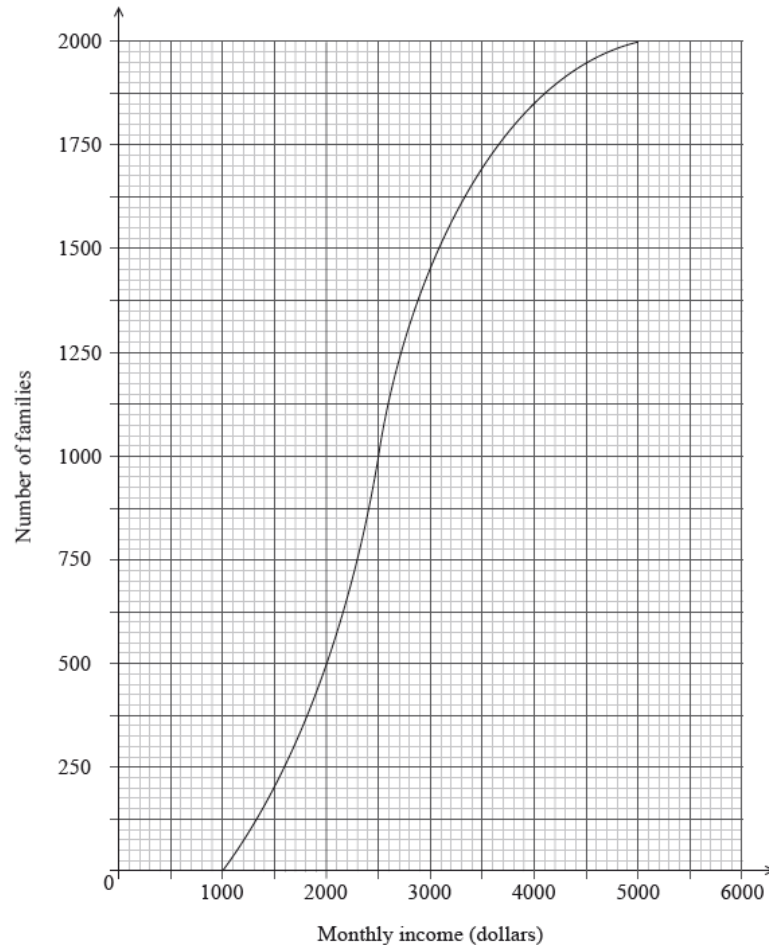
- 8a. Find the probability that the dart does **not** hit the board. [3 marks]

- 8b. The contestant scores points as shown in the following table. [4 marks]

Region	A	B	C	Does not hit the board
Points	0	q	10	-3

Given that the game is fair, find the value of q .

The following cumulative frequency graph shows the monthly income, I dollars, of 2000 families.



9a. Find the median monthly income. [2 marks]

9b. (i) Write down the number of families who have a monthly income of 2000 dollars or less. [4 marks]
(ii) Find the number of families who have a monthly income of more than 4000 dollars.

9c. The 2000 families live in two different types of housing. The following table gives information about the number of families living in each type of housing and their monthly income I . [2 marks]

	$1000 < I \leq 2000$	$2000 < I \leq 4000$	$4000 < I \leq 5000$
Apartment	436	765	28
Villa	64	p	122

Find the value of p .

9d. A family is chosen at random. [2 marks]
(i) Find the probability that this family lives in an apartment.
(ii) Find the probability that this family lives in an apartment, given that its monthly income is greater than 4000 dollars.

9e. Estimate the mean monthly income for families living in a villa. [2 marks]