

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

No calculator on this question

Section A

Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines if necessary.

- 1.** [Maximum mark: 6]

In an arithmetic sequence, $u_2 = 5$ and $u_3 = 11$.

- (a) Find the common difference. [2]

(b) Find the first term. [2]

(c) Find the sum of the first 20 terms. [2]



3. [Maximum mark: 7]

Let $g(x) = x^2 + bx + 11$. The point $(-1, 8)$ lies on the graph of g .

- (a) Find the value of b . No calculator on this question

No calculator on this question

- (b) The graph of $f(x) = x^2$ is transformed to obtain the graph of g .

Describe this transformation.

[4]



Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, for example if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

Section A

Calculator is allowed

Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines if necessary.

- 1.** [Maximum mark: 6]

The number of messages, M , that six randomly selected teenagers sent during the month of October is shown in the following table. The table also shows the time, T , that they spent talking on their phone during the same month.

| | | | | | | |
|---|-----|-----|-----|-----|-----|-----|
| Time spent talking on their phone (T minutes) | 50 | 55 | 105 | 128 | 155 | 200 |
| Number of messages (M) | 358 | 340 | 740 | 731 | 800 | 992 |

The relationship between the variables can be modelled by the regression equation $M = aT + b$.

- (a) Write down the value of a and of b . [3]

(b) Use your regression equation to predict the number of messages sent by a teenager that spent 154 minutes talking on their phone in October. [3]



5. [Maximum mark: 7]

Calculator is allowed

The first two terms of a geometric sequence are $u_1 = 2.1$ and $u_2 = 2.226$.

- (a) Find the value of r . [2]
- (b) Find the value of u_{10} . [2]
- (c) Find the least value of n such that $S_n > 5543$. [3]



12EP06

8. Siân invests 50 000 Australian dollars (AUD) into a savings account which pays a nominal annual interest rate of 5.6% **compounded monthly**.

- (a) Calculate the value of Siân's investment after four years. Give your answer correct to two decimal places.

[3]

After the four-year period, Siân withdraws 40 000 AUD from her savings account and uses this money to buy a car. It is known that the car will depreciate at a rate of 18% per year.

The value of the car will be 2500 AUD after t years.

Calculator is allowed

- (b) Find the value of t .

[3]

Working:

Answers:

(a)

(b)



20EP11

Turn over

3. [Maximum mark: 7]

Calculator is allowed

Let $f(x) = x - 8$, $g(x) = x^4 - 3$ and $h(x) = f(g(x))$.

(a) Find $h(x)$.

[2]

Let C be a point on the graph of h . The tangent to the graph of h at C is parallel to the graph of f .

(b) Find the x -coordinate of C.

[5]



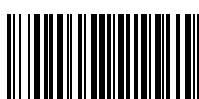
5. [Maximum mark: 6]

No calculator on this question

Consider the function f , with derivative $f'(x) = 2x^2 + 5kx + 3k^2 + 2$ where $x, k \in \mathbb{R}$.

- (a) Show that the discriminant of $f'(x)$ is $k^2 - 16$. [2]

(b) Given that f is an increasing function, find all possible values of k . [4]



Do **not** write solutions on this page.

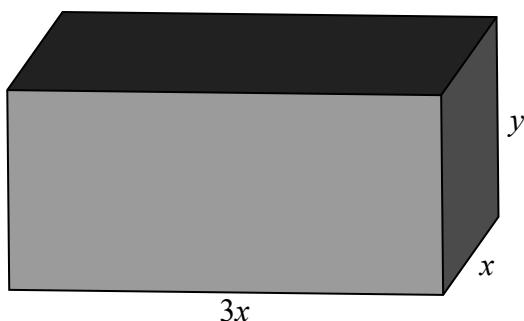
No calculator on this question

Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

8. [Maximum mark: 14]

A small cuboid box has a rectangular base of length $3x$ cm and width x cm, where $x > 0$.
The height is y cm, where $y > 0$.



The sum of the length, width and height is 12 cm.

- (a) Write down an expression for y in terms of x . [1]

The volume of the box is V cm³.

- (b) Find an expression for V in terms of x . [2]

- (c) Find $\frac{dV}{dx}$. [2]

- (d) (i) Find the value of x for which V is a maximum.

- (ii) Justify your answer. [7]

- (e) Find the maximum volume. [2]



12EP09

Turn over