LUI | | | | | | | | | | | Test venue code | | | |

School name

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Thursday 1 June 2017

Question and response book

Mathematics B

Time allowed

Perusal time — 5 minutes
Working time — 60 minutes

General instructions

- Write using black or blue pen.
- Answer all questions in this question and response book.
- A formulae sheet is provided with this paper.

Paper 1 — technology free

Section A

Five short-response questions

Section B

Eight short-response questions

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Queensland Government | QCAA Queensland Curriculum & Assessment Authority

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SECTION A

Instructions

Write your responses in the spaces provided using black or blue pen.

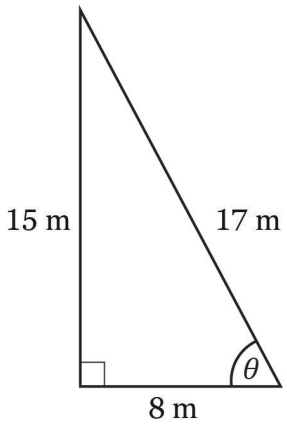
QUESTION 1

For a certain angle θ, where $0° \leq \theta < 360°$, $\sin\theta$ is negative and $\cos\theta$ is positive.

Which quadrant does angle θ belong to?

[1 mark]

QUESTION 2



Not to scale

Using the triangle shown, with respect to the angle labelled θ, which trigonometric ratio does the ratio $\frac{8}{17}$ represent?

[1 mark]

QUESTION 3

What statistical name is given to the spread of data found in the box section of any boxplot (box-and-whisker plot)?

[1 mark]

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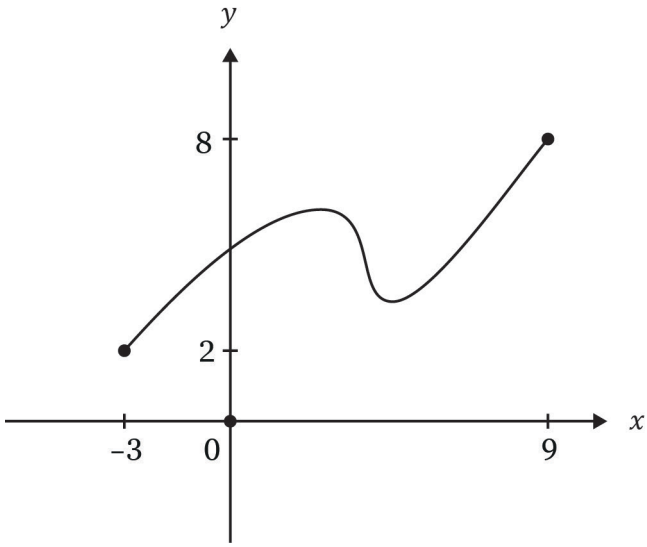
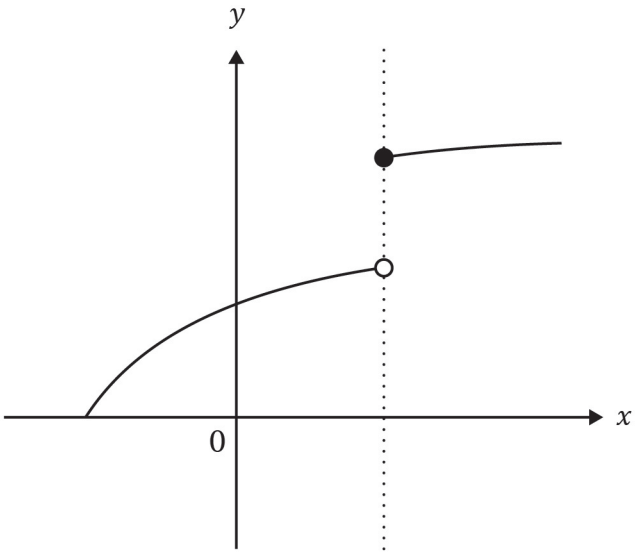
QUESTION 4



What feature of the graph shown above does the interval [2, 8] describe?

[1 mark]

QUESTION 5



What type of function is shown in the graph above?

[1 mark]

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SECTION B

Instructions

- Write your responses using black or blue pen.
- There is no need to fill all the space provided when responding.
- Express fractional answers in their simplest form.
- Questions worth more than one mark require working to be shown to support answers.
- If you need more space for your response, use the additional pages at the back of the book:
  - To cancel your incorrect response, rule a single, diagonal line through your work. If you fail to do this, your original response will be marked.
  - Note the page number of your additional response, i.e. See page ...
- Any additional planning required to complete the questions in Section B may be completed on the planning paper supplied. This planning paper will not be marked.

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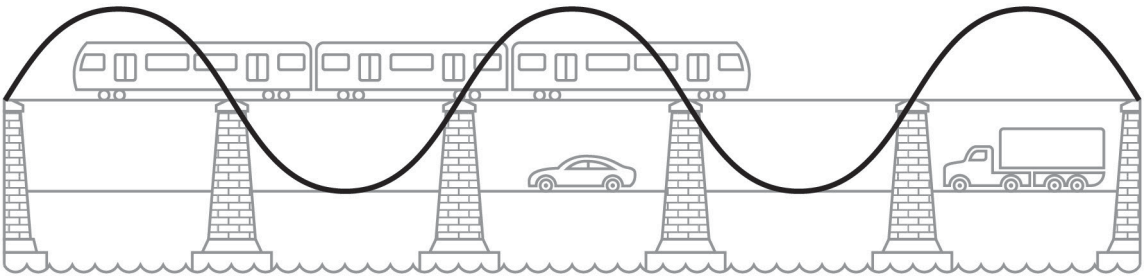
QUESTION 1

The design of a two-level bridge frame can be modelled by a sine wave as shown.

The top level is a train track. The lower level is a road for cars and trucks.

The bridge section shown is 500 metres in length and the distance between the train track and the road is 15 metres.



Not to scale

a) State the amplitude of the sine wave used in the design.

[1 mark]

b) Determine the period of the sine wave used in the design.

[3 marks]

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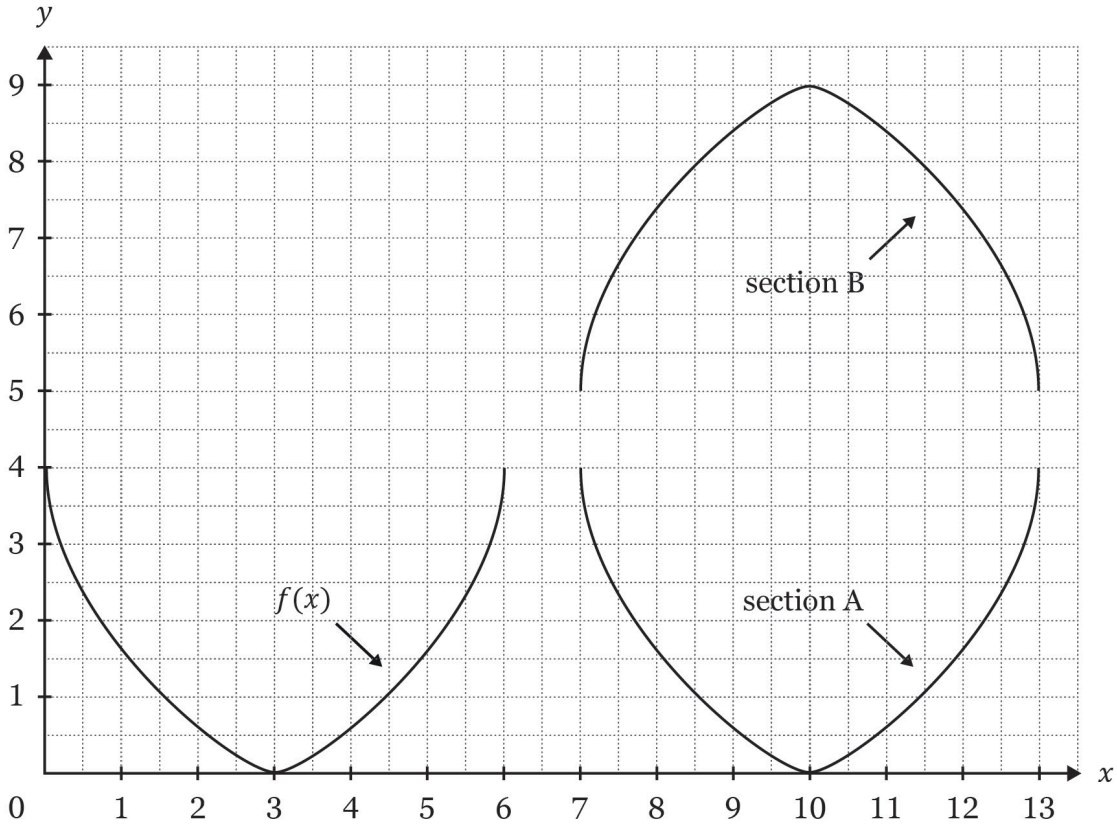
QUESTION 2

A function $f(x)$ defined over the domain $0 \leq x \leq 6$ has been used to form section A and section B shown below.



Transformation notation such as $f(x + a)$, $f(x) + a$, $af(x)$, $f(ax)$ with appropriate values of a can be used to change the position or shape of a function.

a) Using transformation notation, write the function that defines section A.

[2 marks]

b) Using transformation notation, write the function that defines section B.

[3 marks]

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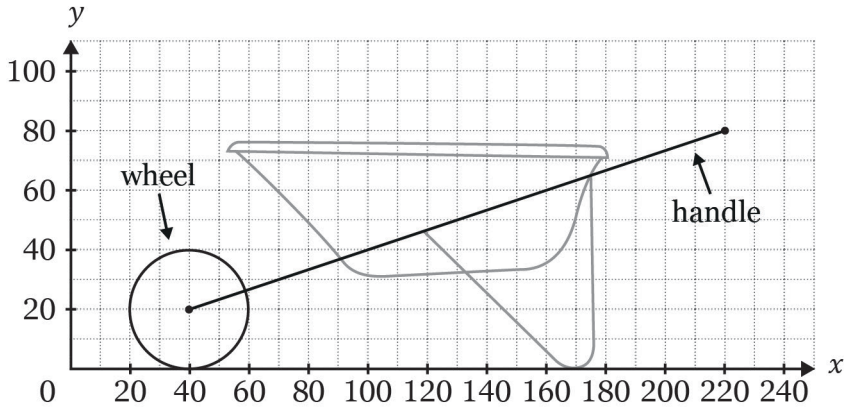
QUESTION 3

A wheelbarrow is designed using relations and functions. All values on the grid are in centimetres.



a) State the domain and the range of the relation used to represent the wheel.

[3 marks]

b) What is the equation of the straight line used to represent the handle?

Express your answer in the form $y = mx + c$.

[6 marks]

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QUESTION 4

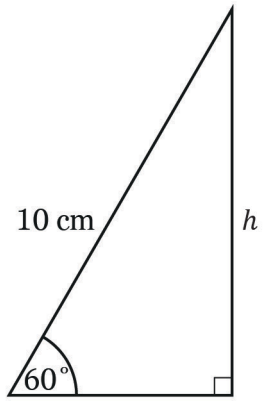
a) State the exact value of $\tan\left(\frac{\pi}{3}\right)$.

[1 mark]

b) Convert $\frac{7\pi}{20}$ radians into degrees.

[3 marks]

c) Determine the exact value of h shown in the triangle below.



Not to scale

[4 marks]

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d) Solve this equation, giving your answer in radians.

$$\sqrt{3}\tan x + 1 = 0 \text{ where } 0 \leq x \leq \pi$$

[6 marks]

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QUESTION 5

A researcher asked two groups of teenagers to record the number of text messages they received or sent in a 24-hour period.

The results for each group are given here as five number summaries.

Group 1	min = x	$Q_1 = 10$	med = 12	$Q_3 = 15$	max = 19
Group 2	min = 0	$Q_1 = y$	med = 9	$Q_3 = 13$	max = 18

The researcher found:

- the interquartile ranges of both groups were equal
- the ranges of the groups differed by 2.

Determine the values of x and y.

[6 marks]

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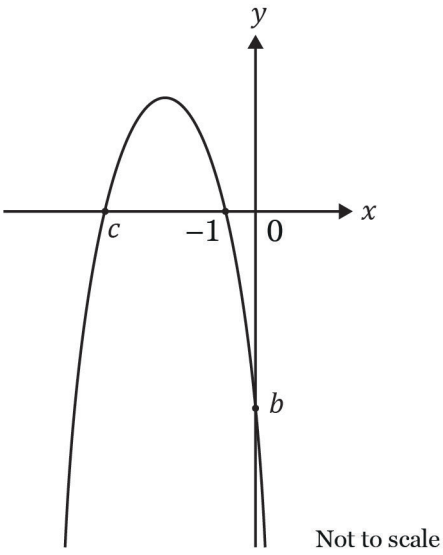
QUESTION 6



The graph of a function $y = a\,(x + 3)^2 + 8$ is sketched above.

Determine the values of a, b and c.

[8 marks]

Do not write outside this box.

QUESTION 7

In this question, use these two functions

$$f(x) = x + 3 \qquad \text{and} \qquad g(x) = x^2 - 4$$

a) Determine $g(f(x))$, giving your answer in the form $ax^2 + bx + c$.

[4 marks]

b) Solve for x: $f(g(x)) = g(f(x))$.

[4 marks]

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QUESTION 8

A rental company has a fleet of 25 minibuses, with a total carrying capacity of 479 passengers.

There are two types of minibus for hire: one holds 13 passengers and the other holds 24 passengers.

Use an algebraic method to determine how many minibuses of each type are owned by the company.

[6 marks]

END OF PAPER 1

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ADDITIONAL PAGE FOR STUDENT RESPONSES

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