— Public use —

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Sample assessment 2020

Question and response book

Mathematical Methods

Paper 1 — Technology-free

Time allowed

- Perusal time — 5 minutes
- Working time — 90 minutes

General instructions

- Answer all questions in this question and response book.
- Calculators are not permitted.
- QCAA formula sheet provided.
- Planning paper will not be marked.

Section 1 (10 marks)

- 10 multiple choice questions

Section 2 (50 marks)

- 9 short response questions

Clear zone — margin trimmed off after completion of assessment

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

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Section 1

Instructions

- Choose the best answer for Questions 1–10.
- This section has 10 questions and is worth 10 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	●	○	○	○

	A	B	C	D
1.	○	○	○	○
2.	○	○	○	○
3.	○	○	○	○
4.	○	○	○	○
5.	○	○	○	○
6.	○	○	○	○
7.	○	○	○	○
8.	○	○	○	○
9.	○	○	○	○
10.	○	○	○	○

Section 2

Instructions

- Write using black or blue pen.
- Questions worth more than one mark require mathematical reasoning and/or working to be shown to support answers.
- If you need more space for a response, use the additional pages at the back of this book.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response, i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has nine questions and is worth 50 marks.

QUESTION 11 (5 marks)

Determine:

a) $\frac{d}{dx}(3\ln(5x))$ *[1 mark]*

b) $\frac{d}{dx}(x^3\cos(x^4+1))$ (You do not need to simplify.) *[3 marks]*

c) $\int 3e^{4x}\,dx$ *[1 mark]*

QUESTION 12 (3 marks)

Simplify the following:

a) $\log_6 9 + 2\log_6 2$ *[1 mark]*

b) $\dfrac{\log_3 16}{\log_3 64}$ *[2 marks]*

QUESTION 13 (4 marks)

Solve the following:

a) $\log_5(2x + 4) = 2$ *[2 marks]*

b) $\ln(7 - x) - \ln 10 = \ln(x)$ *[2 marks]*

QUESTION 14 (5 marks)

Let $v(t) = \frac{1}{\pi} + 3\sin(t)$, $t \geq 0$ represent the velocity of an object moving in a straight line.

At $t = \frac{\pi}{3}$, the position of the object is 4.

a) Determine the acceleration function. *[2 marks]*

b) Determine the displacement function. *[3 marks]*

QUESTION 15 (9 marks)

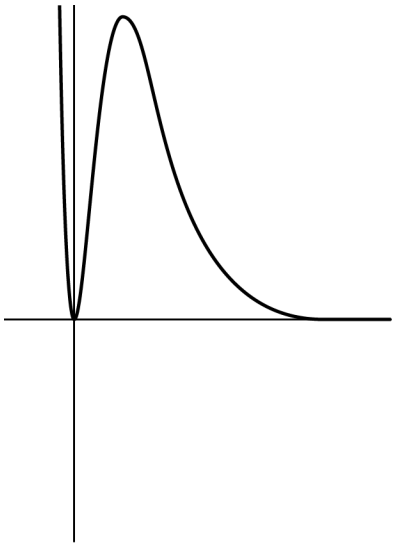
Consider the function: $f(x) = x^2 e^{(-x+4)}$

The first and second derivatives are:

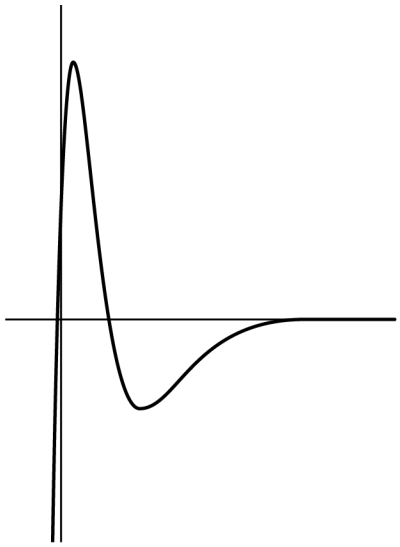
$$f'(x) = x(2-x)e^{(-x+4)}$$
$$f''(x) = (x^2 - 4x + 2)e^{(-x+4)}$$

The graphs of $f(x)$, $f'(x)$ and $f''(x)$ are shown below:

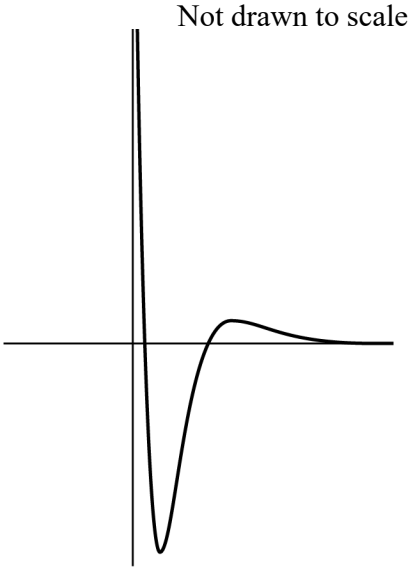
Not drawn to scale



$f(x)$



$f'(x)$



$f''(x)$

a) Determine the coordinates of the local maximum of $f(x)$. *[2 marks]*

b) Use the second derivative test to verify the nature of the stationary point from 15a). *[2 marks]*

c) Determine the x-coordinates of any point/s of inflection. *[2 marks]*

d) Determine the intervals where $f(x)$ is concave up and concave down. *[3 marks]*

QUESTION 16 (5 marks)

Determine the equation of the tangent to the function $y = x^3 + ax^2 + bx + 1$ at the point of inflection (1, 6).

QUESTION 17 (7 marks)

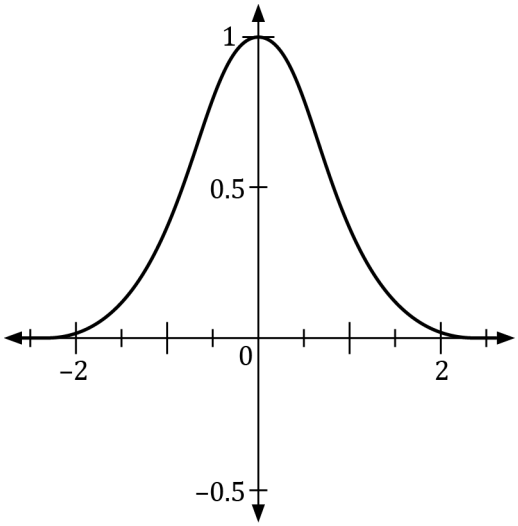
A continuous random variable X has a probability density function f, defined by:

$$f(x) = \begin{cases} a + bx^2 & 0 \leq x \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

If $E(X) = \frac{3}{5}$, determine a and b.

QUESTION 18 (6 marks)

Determine the area of the largest rectangle that has one side on the x-axis and two vertices on the curve $y = e^{-x^2}$. Express your answer in simplest form. The curve is sketched below.



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QUESTION 19 (6 marks)

Determine the equation of the tangent to the curve $y = x\,ln(x)$ that passes through the point $(0, -e)$.

END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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Write the question number you are responding to.

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