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Student Number

**ST PIUS X COLLEGE
CHATSWOOD**

**HSC 2022 Stage 6
Year 12**

Assessment Task #2

25% of School Based Assessment

MATHEMATICS ADVANCED

General Instructions

- Working time – 45 minutes
- Write using black or blue pen
Black pen is preferred
- Draw diagrams using pencil
- NESA approved calculators may be used
- Marks may be deducted for careless or poorly arranged work
- Show all relevant mathematical reasoning and/or calculations
- Write your Student Number at the top of this cover page

Total Marks – 35

Section I – Multiple Choice 5 marks

- Attempt Questions 1 – 5
- Enter responses on the multiple choice answer sheet
- Allow 5 minutes for this section

Section II – 30 marks

- Attempt Questions 6 – 8
- Answer in the writing spaces provided
- Show all necessary working
- Allow 40 minutes for this section

Use the multiple choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$

(A) 2

(B) 6

(C) 8

(D) 9

A ☐

B ☒

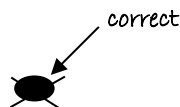
C ☐

D ☐

If you think that you have made a mistake, put a cross through the incorrect answer and fill in the new answer.



If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



1. Which of the following is the derivative of $\log(2x^2 + 1)$?

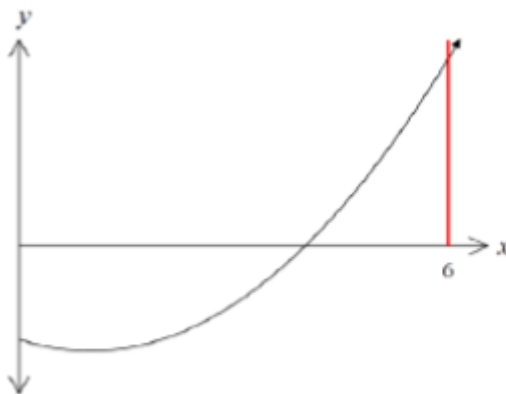
(A) $\frac{2x^2}{2x^2+1}$

(B) $\frac{4x}{2x^2+1}$

(C) $\frac{2x}{2x^2+1}$

(D) $\frac{4x^2}{2x^2+1}$

2. The diagram below shows the graph of $y = x^2 - 2x - 8$.



What is the correct expression for the area bounded by the x-axis and the curve $y = x^2 - 2x - 8$ between $0 \leq x \leq 6$?

- (A) $\int_0^5 (x^2 - 2x - 8) dx + \left| \int_5^6 (x^2 - 2x - 8) dx \right|$
- (B) $\left| \int_0^4 (x^2 - 2x - 8) dx \right| + \int_4^6 (x^2 - 2x - 8) dx$
- (C) $\int_0^4 (x^2 - 2x - 8) dx + \left| \int_4^6 (x^2 - 2x - 8) dx \right|$
- (D) $\left| \int_0^5 (x^2 - 2x - 8) dx \right| + \int_5^6 (x^2 - 2x - 8) dx$

3. Which of the following will give the correct equation of the tangent to the curve $y = f(x)$ at the point $x = a$?

- (A) $y - f(a) = \left(\lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h} \right) (x - a)$
- (B) $y - f(a) = \left(\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \right) (x - a)$
- (C) $y - f(x) = \left(\lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h} \right) (x - a)$
- (D) $y - f(x) = \left(\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \right) (x - a)$

4. The indefinite integral of $\int 2x(x^2 - 3)^3 dx$ is:

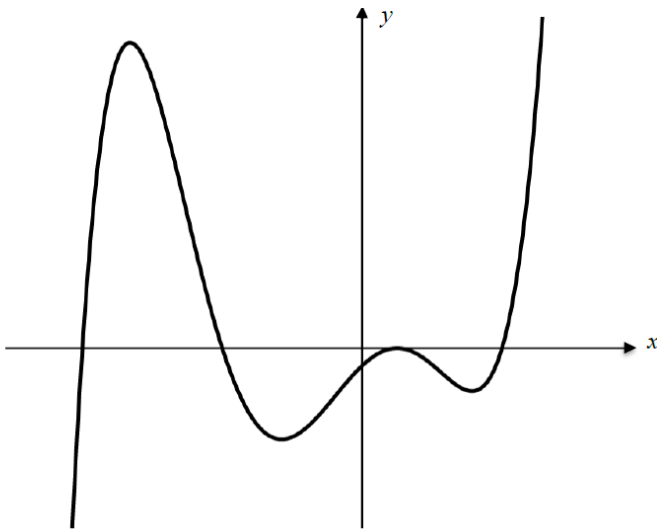
(A) $\frac{1}{4}(x^2 - 3)^4 + C$

(B) $\frac{x}{4}(x^2 - 3)^2 + C$

(C) $\frac{1}{8}(x^2 - 3)^4 + C$

(D) $2x(x^2 - 3)^3 + C$

5. The graph of $y = f(x)$ is shown below.



What is the number of stationary points and points of inflection in the graph of $y = f(x)$?

(A) 3 stationary points and 3 points of inflection

(B) 3 stationary points and 4 points of inflection

(C) 4 stationary points and 3 points of inflection

(D) 4 stationary points and 4 points of inflection

End of Section I

Attempt Questions 6 to 8.

Allow about 40 minutes for this section.

In Questions 6 to 8 your responses should include relevant mathematical reasoning and/or calculations.

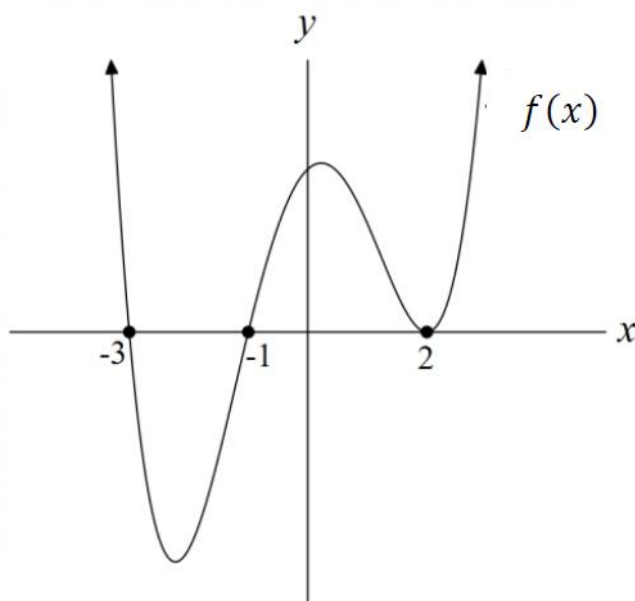
Question 6 (10 marks)

Write your solutions in the spaces provided

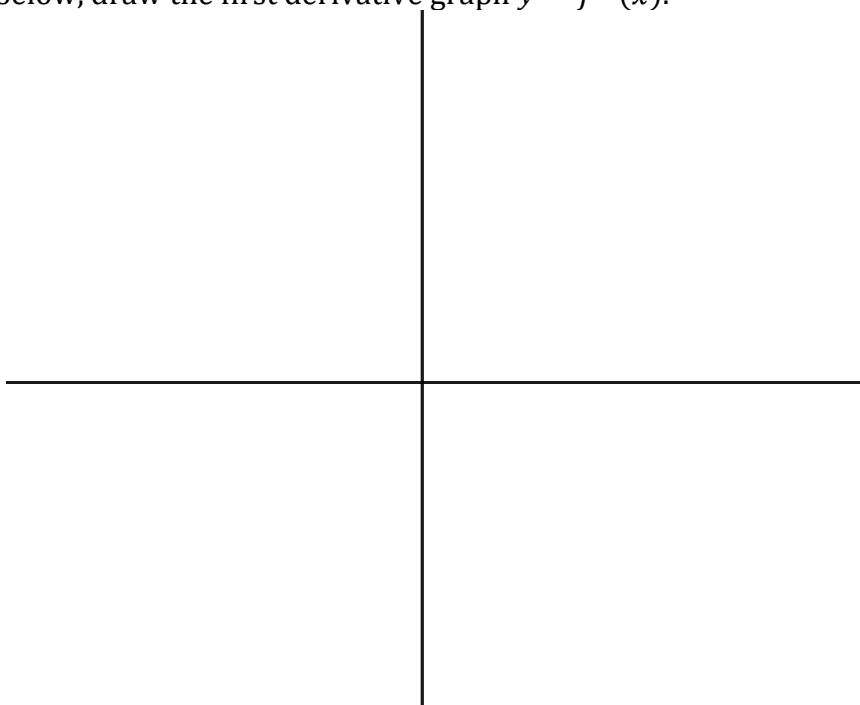
Marks

- (a) The diagram below shows the graph of a quartic function $y = f(x)$.

2



In the space below, draw the first derivative graph $y = f'(x)$.



(b) For the function $f(x) = x^3(4 - x)$:

i) Find the coordinates of any stationary points.

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ii) Determine the nature of the stationary points.

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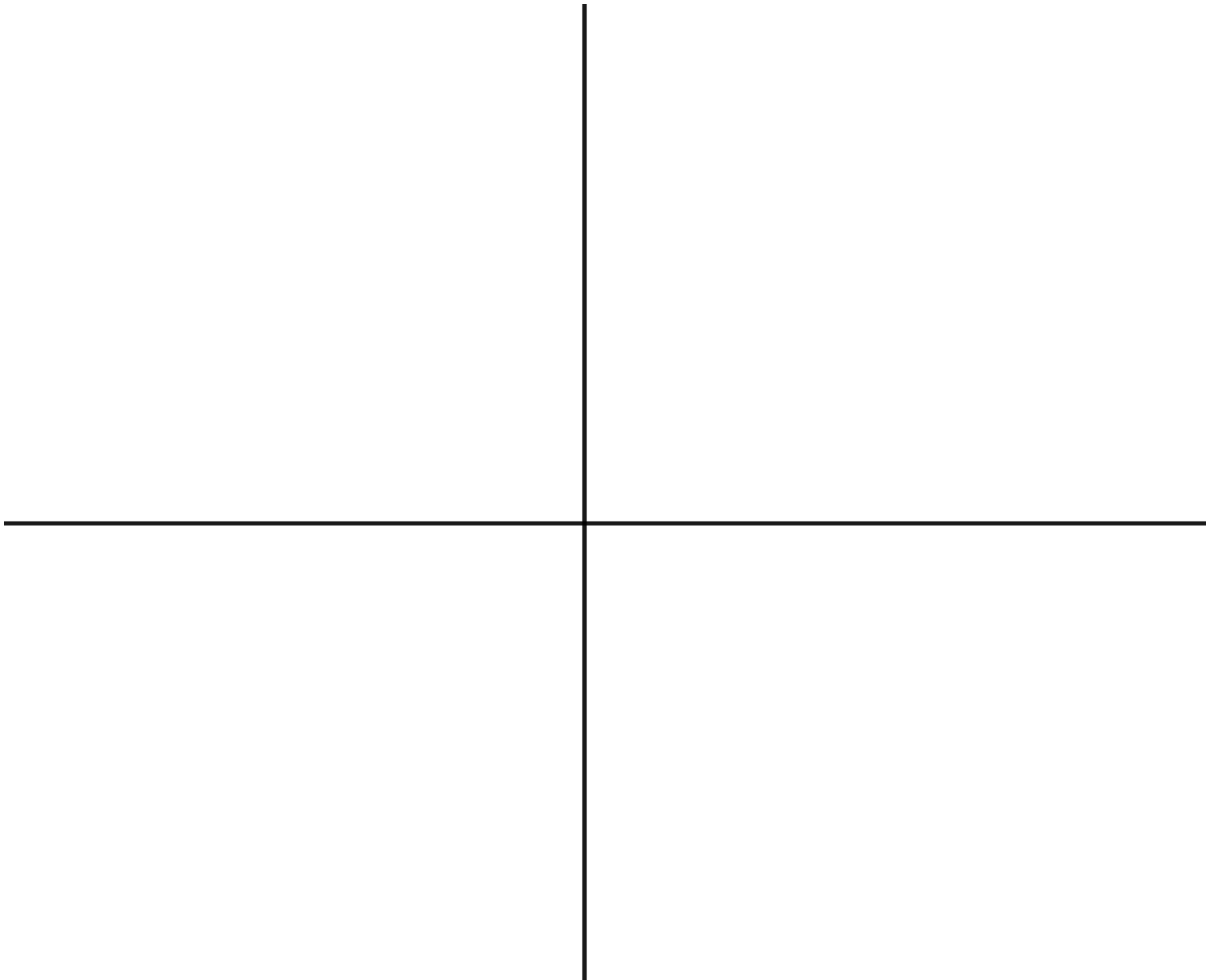
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iii) Draw the graph showing all relevant points.

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c) Find the indefinite integral of $\int 5x^4 + 3x^2 - 2 \, dx$

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Question 7 (10 marks)

Write your solutions in the spaces provided

Marks

- (a) By firstly differentiating $y = \sqrt{2x^2 - 4}$, find $\int \frac{x}{\sqrt{2x^2 - 4}} dx$.

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- (b) Find the area of the region bounded by the graph $y = x^3$, between $x = -1$ and $x = 3$.

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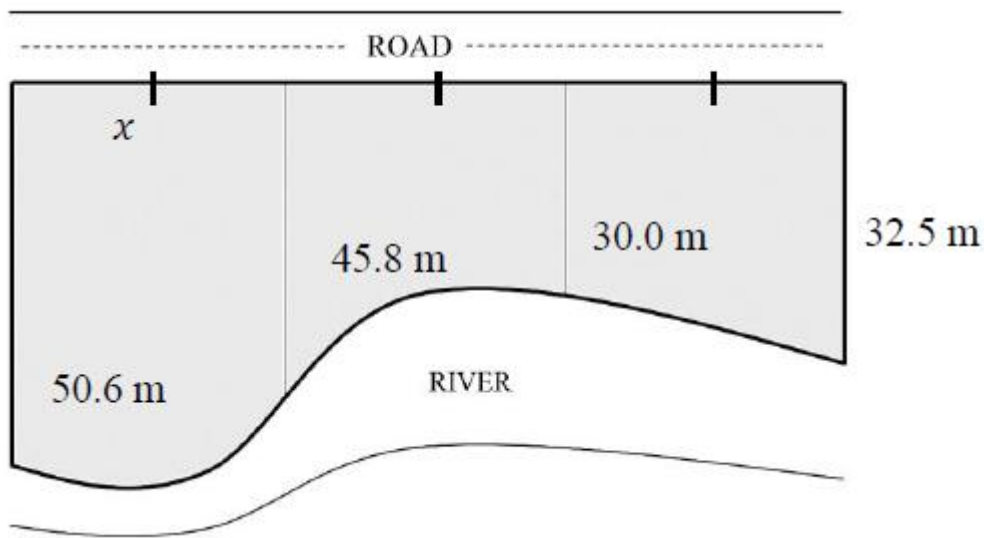
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- [illegible]

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- (d) A field (shaded), is bordered on one side by a 120 metre of road and on the other side by a river. Measurements are taken from the road to the river, as shown.



- (i) Find the value of x .

1

- (ii) Use the Trapezoidal Rule to find an approximation of the area of the field. Correct your answer to the nearest square metre.

2

Question 8 (10 marks)

Write your solutions in the spaces provided

Marks

(a) Differentiate:

i) $\frac{2x+1}{e^{2x}}$

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ii) $3x^4e^{2x}$

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iii) $y = \log_e(3x^2 + 2x - 3)$

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(b) If $\frac{dy}{dx} = e^x + 2$, find y when $x = 1$, given that $y = 4$ when $x = 0$.

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(c) If $y = \log_e x$, show that $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 = 0$.

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End of Task

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

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Student Number

Mathematics Advanced – Multiple Choice Questions Answer Sheet

Attempt all questions:

- | | | | | | |
|----------|---|-------------------------|-------------------------|-------------------------|-------------------------|
| Question | 1 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 2 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 3 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 4 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| | 5 | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |

