



APPLECROSS
SENIOR HIGH SCHOOL

STUDENT NAME: _____

All working must be shown in the space provided. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than 2 marks, valid working or justification is required to receive full marks.

	Total	Result	%
Section 1	26		
Section 2	29	12	
Total	55		

Section 1: Resource – Free

Working time: 25 minutes

Question 1 [2, 2, 3 = 7 marks] *3.1.9, 3.1.9, 3.1.9*

Determine the derivative of each of the following. Express your answers with positive indices.

a) $y = (3x - 3)^3$

b) $y = \frac{4x^3}{2x+1}$ (Do not simplify)

c) $y = \frac{1}{2}x^2(\sqrt[3]{1-3x})$ (Do not simplify)

Question 2 [3, 3 = 6 marks]

For each of the following, find $f(x)$, simplifying where possible.

a) $f'(x) = \frac{3x^4 + x}{\sqrt{x}}$

b) $f'(x) = 2(6x - 5)^3$

Question 3 [2, 3 = 5 marks]

The cost (in dollars) to make x cans of "Tony's Penguin Food" can be modelled by the function;

$$C(x) = 0.25x^2 - x + 15, \quad \text{where } 0 \leq x \leq 60$$

a) Determine the marginal cost when 40 cans are made.

b) Determine the average rate of change in cost when making the first 50 cans.

Question 4 [3 marks]

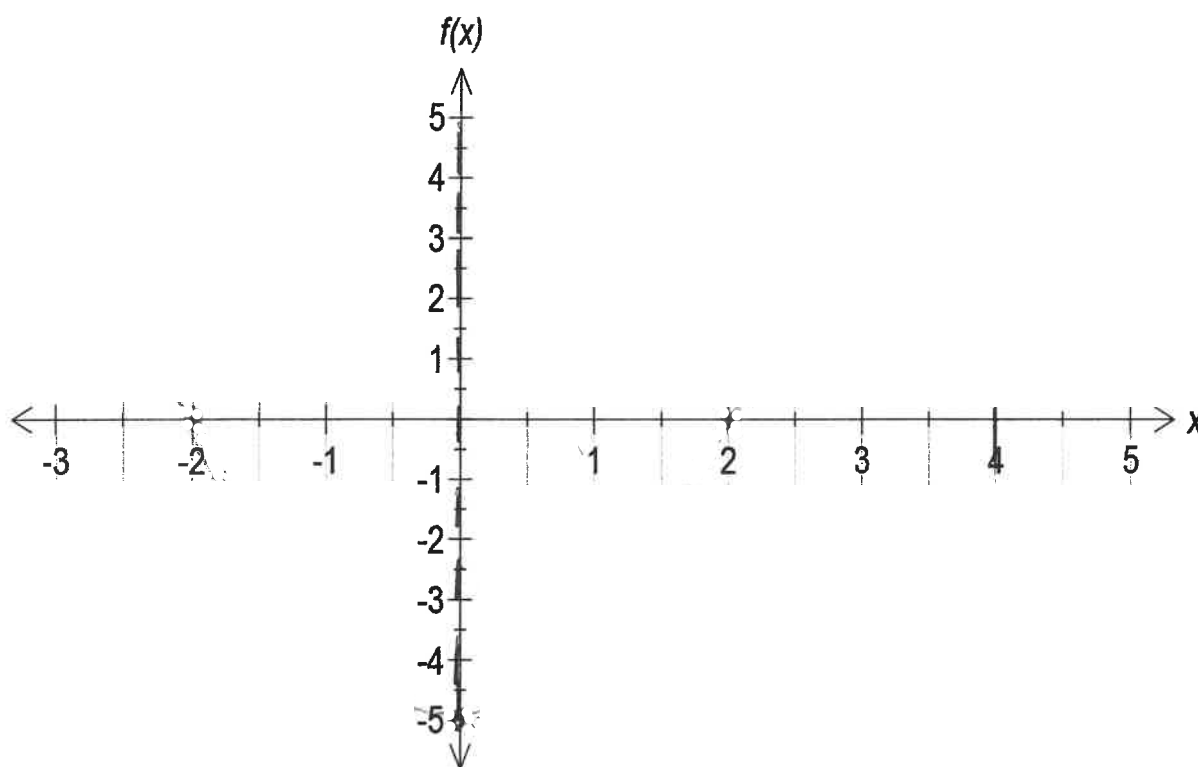
A side of a cube is measured with 3% error.

Find the approximate percentage error in the surface area of the cube.

Question 5 [5 marks]

On the axes below, sketch a function $f(x)$ (over the domain $-3 \leq x \leq 5$) that satisfies all of the following conditions listed.

- $f(-2) = f(2) = 0$ ✓
- $f'(0) = f'(4) = 0$
- $f''(4) = 0$
- $f''(x) < 0$ ONLY when $2 < x < 4$
- $f'(x) < 0$ ONLY when $x < 0$
- The global maximum and minimum of $f(x)$ over this domain are 5 and -5 respectively.
- $f(5) = 4$

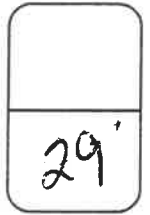


END OF SECTION 1



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STUDENT NAME: Solutions



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Section 2: Resource – Rich

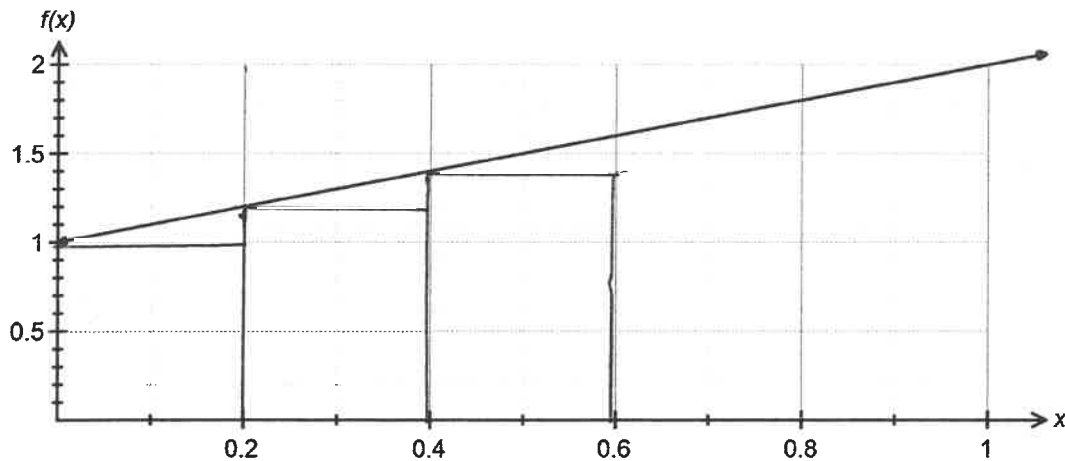
Working time: ~~25~~ minutes
30

To be provided by the student:

ClassPad and/or Scientific Calculators
1 sheet of A4-sized paper of notes, double-sided

Question 6 [1, 2, 2 = 5 marks]

Consider the function $f(x)$ drawn below.



- Draw rectangles on your graph that can be used to underestimate the area under $f(x)$ over the domain $0 \leq x \leq 0.6$, where $\delta x = 0.2$.
- Determine the underestimated area of $f(x)$
- Use the graph of $f(x)$ above to calculate $\int_0^{0.6} f(x) dx$

Question 7

[3, 3, 3 = 9 marks]

Given the curve with the equation $y = \frac{2x^2-1}{3-x^2}$.

a) This curve has only one stationary point. Use calculus methods to find the coordinates of this point.

b) Use the second derivative test to determine the nature of the stationary point.

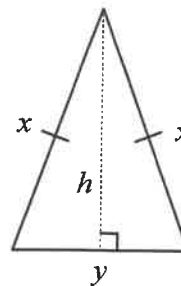
c) Are there any inflection points? Justify your answer using calculus.

Question 8

[3, 5 = 8 marks]

An isosceles triangle has a perimeter of 60cm. If the two equal sides are labelled x , the third side y , and the perpendicular height h :

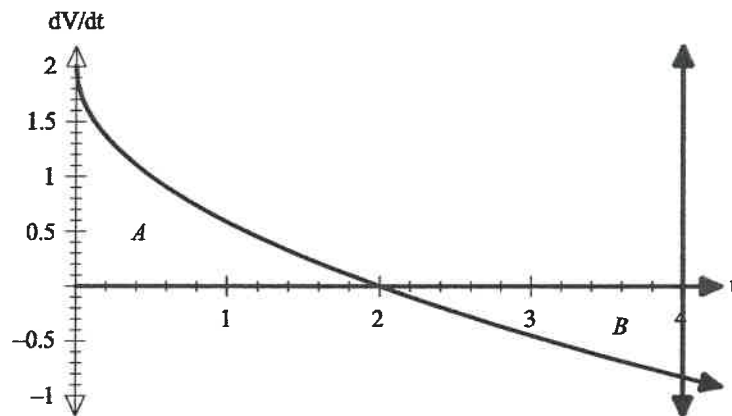
- a) If it is known that $y = 60 - 2x$, show that $h = \sqrt{60x - 900}$



- b) Using calculus, determine the values of x , y and the area of the triangle if the area of the triangle is maximized.

Question 9 [1, 2, 2, 2 = 7 marks]

The instantaneous rate with which the amount of liquid, V litres, in a tank, changes with respect to time t minutes, is modelled by $\frac{dV}{dt} = -\sqrt{2t} + 2$. The sketch of $\frac{dV}{dt}$ against t is shown below.



a) Explain what happens in the tank after 2 minutes

b) Find the area of region A and interpret your answer

c) Find the area of region B and interpret your answer

d) Find the amount of liquid in the tank after 4 minutes, if initially there were 16 litres in the tank.