

STUDENT'S NAME

DATE: Thursday 1st March

TIME: 30 minutes

MARKS: 28

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser.

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

I. (5 marks)

Determine $\frac{dy}{dx}$ for the following. Do not simplify your answers.

(a) $y = \frac{3x^3 - 2x + 5}{x}$

[2]

(b) $y = \sqrt[3]{(2x^3 + 7)^5(2 - x)}$

[3]

A particle M moves in rectilinear motion such that its acceleration, a , in m/s^2 at any time, t , seconds(s) is given by:

$a = 6t - 3$ where $t \geq 0$.

After 2 seconds, the particle's displacement is $-23m$ and it is travelling at a velocity of $-30ms^{-1}$

(a) By first determining the expression of velocity in terms of t , calculate the velocity of the particle after 1 second from its origin.

[4]

(b) Determine the distance travelled by particle M from $t = 2$ to $t = 5$.

[4]

2. (3 marks)

Given $y = \frac{u^3}{3} + 3u$ and $x = \frac{u+1}{2}$, determine $\frac{dy}{dx}$.

3. (5 marks)

Determine the value(s) of a under which the curve $y = x^3 + ax^2 + 3x + 2$ will have exactly one stationary point.

8. (7 marks)

The cost of a listed share in C cents, is modelled by $C = 75\sqrt{1+0.8t}$ for $t \geq 0$, where t is the number of years after 2000.

(a) Determine the cost per share in 2000. [1]

(b) Determine the average rate of cost rise between 2000 and 2010. [2]

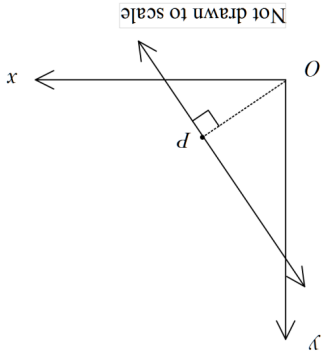
(c) Determine the instantaneous rate of cost rise in 2005. [2]

(d) Determine when the instantaneous rate of cost rise is 10 cents per year. [2]

7.

(6 marks)

An ant crawls along the line $y = -10x + 38$ drawn on the axes below.



- (a) Given the minimum distance occurs at P, show that the length of OP is $\sqrt{x^2 + (-10x + 38)^2}$.

[2]

- (b) Using calculus techniques, determine the minimum distance between the ant and the origin and the location this occurs.

[4]

4.

(9 marks)

Determine each of the following.

(a) $\int 3x^2 - \frac{\sqrt{x}}{1} + e \, dx$

(b) $\int \frac{5x^2}{2x^3 - 4x^2} \, dx$

(c) $\int \frac{-3}{\sqrt{7x+9}} \, dx$

[3]

[3]

[3]

5. (6 marks)

Using calculus techniques;

- (a) Determine all stationary points of the function $y = \frac{x^3}{3} + 2x^2 + 3x - 2$ [3]

- (b) Showing full algebraic reasoning state the nature of each of these stationary points. [3]



Mathematics Methods Units 3,4
Test 1 2018

Section 2 Calculator Assumed
Differentiation, Applications of Differentiation, Anti Differentiation

STUDENT'S NAME _____

DATE: Thursday 1st March

TIME: 20 mins

MARKS: 24

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser.

Special Items: Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

6. (3 marks)

A small metal sphere with a radius of 0.58 cm is dipped in gold. The coating of the gold is 0.02 cm thick. Use the derivative to approximate the increase in volume of the sphere.