



KINGSWAY CHRISTIAN COLLEGE

MATHS DEPARTMENT

Course: Math Methods unit 3

Assessment Task: Test 2

Student Name: _____

Date: 23rd & 24th March 2017

Assessment Score: _____ / 50

Year Score: _____

Comments: _____

Teacher signature: _____

Parent/ Guardian signature: _____

Comments: _____

Math Methods Unit 3 Test 2 2017
Differentiation

Resource Free

Time: 30 minutes

Marks: / 27

Only a formula sheet is allowed for this section. No calculator or notes allowed.

Question 1

(6 marks)

- (a)** For what values of c does the polynomial $P(x) = x^3 + c x^2 + 2x$ have an inflection point where $x = 3$? (3 marks)

- (b)** Sketch the graph of a function that such that:

(3 marks)

- $f'(x) > 0$ for all $x, x \neq 1 \wedge x \neq 3$
- vertical asymptote at $x = 1$
- $f(x) > 0$ if $x < 1 \vee x > 3$
- $f(x) < 0$ if $1 < x < 3$
- $f''(3) = 0$ and $f'(3) = 0$

Question 2**(6 marks)**

Determine the maximum and minimum value for $f(x)$ and the value of x at which they occur, for the function $f(x) = 3x^4 - 16x^3 + 18x^2$ over the domain $-1 \leq x \leq 2$.

Question 3**(7 marks)**

Determine the coordinates of all intercepts, stationary points and points of inflection of the function $y = x e^{3x}$.

Justify the nature of the stationary points found using a standard test.

Question 4**(3 marks)**

Determine the equation of the normal to the curve $y = x(3 - x)^2$ at (2,2).

Question 5**(5 marks)**

Find the equation of the tangent to the curve $y = 2x + \cos 2x$ at the point $(\frac{\pi}{3}; \frac{2\pi}{3} - \frac{1}{2})$.

Math Methods Unit 3 Test 2 2017 Differentiation

Name_____

Resource Assumed

Time: 25 minutes

Marks: / 23

CAS calculator and a formula sheet are allowed for this section

Question 6

(5 marks)

A cylindrical can is to be made to hold $1\,000\text{ cm}^3$ of oil. Find the dimensions that will minimise the amount of the metal to make the can. Assume the can is made with a lid.

Question 7**(9 marks)**

The cost in dollars of producing x items is given by: $C(x) = (3000 + 5x)$.

The revenue per item sold is given by $\$(40 - 0.02x)$.

(a) State the revenue function $R(x)$ for x number of items sold. (1 mark)

(b) Give an expression for the profit function $P(x)$. (1 mark)

(c) Determine how many items are needed to make a maximum profit and state the maximum profit. (3 marks)

(d) Explain clearly if a loss occurred and when it occurred. (2 marks)

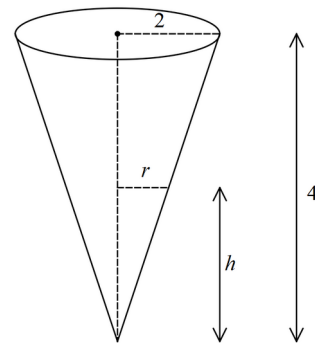
(e) Determine the marginal profit of the 250th item sold. (2 marks)

Question 8**(4 marks)**

Use derivatives to find the approximate change in the radius of a spherical balloon corresponding to a change in its volume from 200 cm^3 to 195 cm^3 . Answer to 4 decimal places.

Question 9**(5 marks)**

A water tank has the shape of an inverted circular cone with base radius 2 m and height 4 m.



- (a) Prove that the volume of the tank is given by the following formula:

$$V(h) = \frac{1}{12} \pi h^3$$

(1 mark)

- (b) If water is being pumped into the tank at a rate of $2 \text{ m}^3/\text{min}$, find the rate at which the water level is rising when the water is 3 m deep.

Answer to the nearest cm/min.

(4 marks)