



Yr 12 METHODS TEST 1 2018

**DIFFERENTIATION, APPLICATIONS
AND LOGARITHMS**

Time: 30 minutes

Total: 28 marks

Student Name: _____

Teacher: _____

Instructions: *Show all working clearly.*

Sufficient detail must be shown for marks to be awarded for reasoning.

NO CALCULATOR AND NO PERSONAL NOTES ALLOWED

Question 1. (9 marks)

- a) Determine the tangent of the graph of $y = 2(3x^2 + 2)^3$ at the point (1,250)

[4]

- b) Determine the coordinates of any stationary points on the function $y = \frac{x+7}{x-2} + x$

[5]

Question 2. (6 marks)

Given that $\log_9 5 = a$ and $\log_9 6 = b$, write the following in terms of a and b .

a) $\log_9 25$ [1] b) $\log_9 180$ [2]

c) $\log_9 18$ [3]

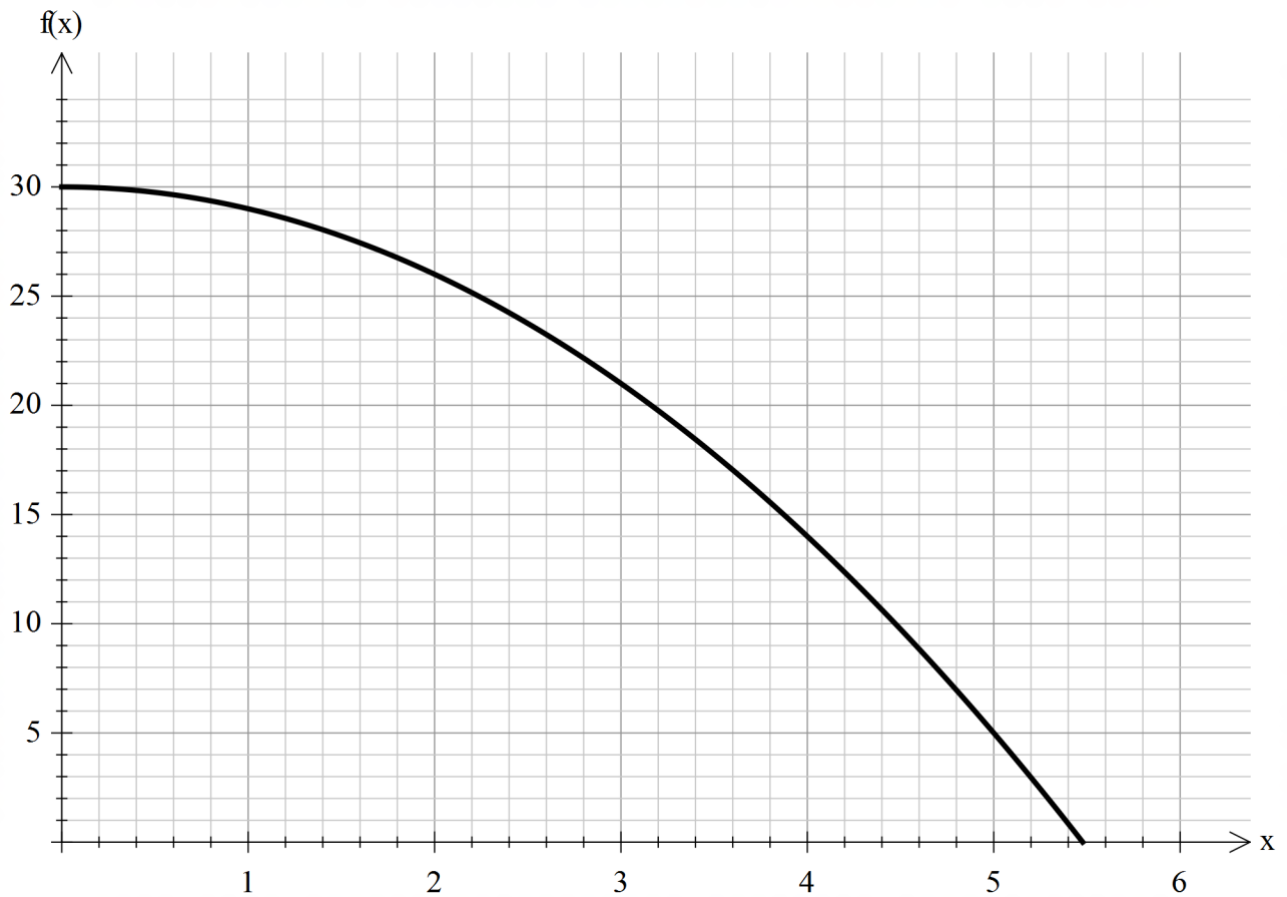
Question 3. (4 marks)

A sphere is has an initial volume of $\frac{32\pi}{3} \text{ cm}^3$.

Use the incremental formula to determine the change in radius if the volume of the sphere is increased by 3cm^3 .

Question 4. (9 marks)

Consider the graph below of $f(x) = -x^2 + 30$ $0 \leq x \leq \sqrt{30}$



Rectangles can be created by drawing a vertical line up from any x value until that line hits the curve and then horizontally until it hits the y axis.

- a) Draw in two such rectangles. One using an x value of 1 and the other using an x value of 4. [1]
- b) Calculate the area of each of these two rectangles. [2]

Question 4 (continued)

- c) Use calculus to determine the exact x value that would give the rectangle with the greatest area. [4]

- d) State the exact maximum area of this rectangle. [2]



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**DIFFERENTIATION, APPLICATIONS
AND LOGARITHMS**

Time: 25 minutes

Total: 25 marks

Student Name: _____

Teacher: _____

Instructions: *Show all working clearly.*

Sufficient detail must be shown for marks to be awarded for reasoning.

CALCULATOR AND 1 PAGE OF PERSONAL NOTES ALLOWED

Question 5. (9 marks)

A small body is moving in a straight line with displacement $x(t) = \frac{2t^3}{3} - \frac{19t^2}{2} + 30t$ m, where t is the time in seconds, since the body first passed through the origin.

a) Determine an expression for $v(t)$, the velocity of the body at time t . [2]

b) Show that the body is stationary twice and find the change in displacement of the body between these two moments. [4]

c) Determine the position of the body when it's velocity is a minimum. [3]

Question 6. (8 marks)

A cylindrical oil drum, of radius r m and height h m, has circular ends constructed from material costing \$75 per square metre and sides constructed from material costing \$40 per square metre.

- a) Determine an expression for the cost of construction C , in dollars. [1]
- b) If the oil drum must be constructed for \$250, show that the volume of the oil drum is given by, $V = \frac{25r - 15\pi r^3}{8}$ [3]
- c) Use calculus methods to determine the dimensions that maximise the volume of the oil drum, and state this maximum volume. [4]

Question 7. (8 marks)

A polynomial function $f(x) = ax^4 + bx^2 + c$, where a, b and c are real constants, has the following features:

- $f(x) = 0$ **only** for $x = -2$ and $x = 2$
- $f'(x) = 0$ **only** for $x = -1, x = 0$ and $x = 1$
- $f'(x) > 0$ **only** for $-1 < x < 0$ and $x > 1$
- $f''(0) < 0$

a) At the point where the curve intersects the y axis, is the graph concave up or concave down? Explain your answer. [2]

b) Is c positive or negative? Explain your answer. [2]

c) Sketch a possible graph of the function on the axes below. [4]

