



SHENTON
COLLEGE

Year 11 Mathematics Methods (AEMAM)

Test 5 2016

Calculator Free

Time Allowed: 20 minutes

Marks / 25

Name: *Marking Key*

Circle Your Teachers Name: McRae Friday Mackenzie

1. [5,2 marks]

(a) Show use of calculus methods to determine the coordinates and nature of any stationary points of the function $f(x) = 3x^2 - x^3$.

(b) Determine the minimum and maximum values of $f(x)$ if $-2 \leq x \leq 3$

2. [2,3 marks]

Determine the antiderivative of:

(i) $\frac{dy}{dx} = 3x^3 + 4$

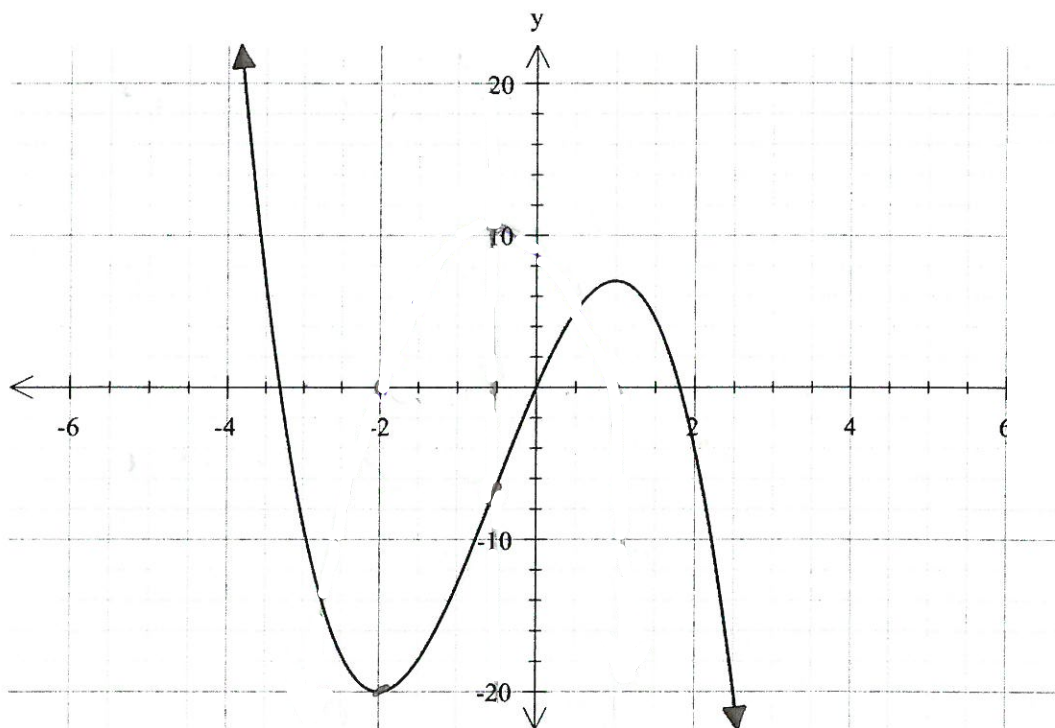
(ii) $\frac{dy}{dx} = \frac{9x^3 - 8x^4}{x^2}$

3. [3 marks]

The function $y = x^3 + ax + b$ has a local minimum point at (2,3). Use differentiation to find the values of a and b .

4. [3,2 marks]

Below is a graph of $y = f(x)$



a) State the value(s) of x for which:

i) $f'(x) < 0$

ii) $f'(x) = 0$

iii) $f'(x) > 0$

b) On the grid above, draw a possible graph of $y = f'(x)$

5. [3,2 marks]

(a) Determine the rule for the curve that passes through (1,-1) with a gradient function $f'(x) = 6(1 - x^2)$.

(b) Find the equation of the tangent to the curve at the point (2,-9)



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Marks / 32

Name:
.....

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6. [5 marks]

Given that $A = x^2y$ and $x + y = 10$, where $x > 0$, use a calculus method to determine the maximum value of A and the corresponding values of x and y . Give exact answers.

7. [4 marks]

The total cost of producing x blankets per day is $\frac{1}{4}x^2 + 8x + 20$ dollars and each blanket may be sold at $(23 - \frac{1}{2}x)$ dollars.

Use a calculus method to determine how many blankets should be produced each day to maximise the total profit.

8. [1,2,1,2,2 marks]

A bullet is fired upwards. After t seconds the height of the bullet is found from the rule

$H(t) = 150t - 4.9t^2 + 2$ where t is measured in seconds and H in metres.

(a) Find the height of the bullet after 5 seconds.

(b) Determine the average speed of the bullet during the fifth second.
Indicate your method.

The speed of the bullet is the instantaneous rate of change of the height of the bullet.

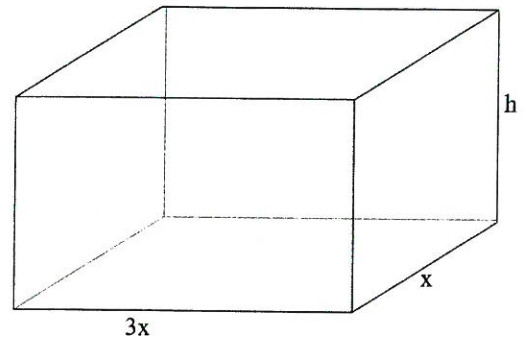
(c) Find the speed of the bullet after 5 seconds.

(d) Find the maximum height of the bullet, to the nearest metre.

(e) Determine the bullet's speed as it hits the ground, on the way down correct to two decimal places.

9. [2,1,3 marks]

A piece of wire, 300cm long is used to make the 12 edges of the frame of a rectangular box. The length of the rectangular frame is three times that of the width of the frame, x cm.



(a) Show that the height, h , of the rectangular box is given by, $h = 75 - 4x$.

(b) Show that the volume, V , of the box is given by $V = 225x^2 - 12x^3$

(c) Use a calculus method to determine the dimensions of the frame that will maximize the volume of the box.

10. [1,1,3,4 marks]

The displacement s (in metres) at time t (in seconds) of a particle moving in a horizontal straight line is given by:

$$s(t) = (t - 3)(2t + 3)(t - 6)$$

Determine

- (a) The initial displacement of the particle.
- (b) the displacement of the particle when $t=4$.
- (c) When the particle changes direction, using calculus.
- (d) The total distance travelled in the first four seconds (to the nearest metre).

