



Name: .....

SHENTON COLLEGE  
Teacher: Mrs Martin Dr Moore Mr Smith

Time Allowed : 30 minutes

Marks /30

**Materials allowed:** Formulae Sheet provided.

**Attempt all questions.**

*All necessary working and reasoning must be shown for full marks.  
Marks may not be awarded for untidy or poorly arranged work.*

**Question 1 [4, 2, 2 = 8 marks]**

Determine the following:

(a)  $\int (e^{2x} + \sqrt{x} + \pi) dx$

(b)  $\frac{d}{dx} \int_3^x \frac{4}{t^2} dt$

(c)  $\frac{d}{dx} \int_x^0 \sqrt{1+t^2} dt$

**Question 2 [3, 4 = 7 marks]**

Evaluate

(a)  $\int_{\frac{\pi}{2}}^0 \frac{(2x+1)^4}{3} dx$

(b)  $\int_{\frac{3\pi}{2}}^{\frac{\pi}{2}} 2 \sin 2x dx$

**Question 3** [ 1, 3 = 4 marks]

Given  $\int_0^{-3} f(x)dx = 1$  and  $\int_0^2 f(x)dx = -5$ , find

(a)  $\int_{-3}^2 f(x)dx$  (b)  $\int_0^2 [3f(x) - 4]dx$

**Question 4** [5 marks]

Given  $\frac{dy}{dx} = ae^x + 1$  and when  $x = 1$ ,  $\frac{dy}{dx} = 3$  and  $y = 2$

Find the value of  $y$  when  $x = 0$ .

Question 3

[ 2, 3 = 5 marks ]

The ratio of the radius (r) to the height (h) is 5:3 for a specific cone.

(a) Show that the volume of the cone is given by  $V = \frac{25\pi}{27} h^3$

(b) Use the method of small change to find the approximate increase in the volume of the cone if the height changes from 5 cm to 5.02 cm.

c)  $h\left(\frac{x}{2}\right)$

a)  $h'(x)$

Given  $h(x) = \int_x^0 \cos(2t)dt$ , determine

b)  $h'\left(\frac{x}{2}\right)$

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

Question 4

[2, 3 = 5 marks ]

The cost,  $C(x)$  (\$1000s) of manufacturing a product is given by  $C(x) = 45 + 65x$ . The revenue,  $R(x)$ , is given by the function  $R(x) = 100x - 2.5x^2$ . The manufacturer can only make between 2 and 10 products per week.

Find

(a) a simplified expression for the Profit if  $x$  units are made and sold.

(b) the minimum and maximum profit possible each week.



Mathematics Methods 3 and 4  
Test 2 Calculator Assumed

Name: .....

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Time Allowed: 20 minutes

Marks	/27
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**Materials allowed:** Formulae Sheet provided. Classpad, calculators, 1 A4 page of notes, one side.

**Attempt all questions.**

**All necessary working and reasoning must be shown for full marks.**

*Marks may not be awarded for untidy or poorly arranged work.*

**Question 1 [2, 2, 2, 2 = 8 marks]**

The acceleration ( $m/s^2$ ) of a particle moving in a straight line is given by  $a = 2t - 4$ . The particle's initial velocity is 3 m/s. Its initial displacement from the origin is -15 m.

(a) Find the expression for the particle's velocity at any time.

(b) Find the time(s), if any, when the particle comes to rest.

(c) Find its displacement when  $t = 3$

(d) Find the distance travelled in the first 3 seconds.

**Question 2 [3, 6 = 9 marks]**

Consider the functions:  $f(x) = x(5 - x)$  and  $g(x) = x(x - 3)$

(a) Write down an integral which when evaluated will determine the area trapped between the two functions and calculate the area.

(b) Within the area trapped between the two functions a vertical line is drawn, intersecting  $f(x)$  at Point P and intersecting  $g(x)$  at Point Q.

(i) Show use of calculus to find the value of  $x$  for which the length of line segment PQ is a maximum.

(ii) Use the second derivative test to show that this value of  $x$  does indeed produce a maximum value.

(iii) State the maximum length possible.