

Year 12 Methods Units 3,4
Test 1 2019

Section 1 Calculator Free
Differentiation, Applications of Differentiation, Integration, Applications of Integration

STUDENT'S NAME _____

DATE: Friday 8th March

TIME: 20 minutes

MARKS: 21

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.

1. (4 marks)

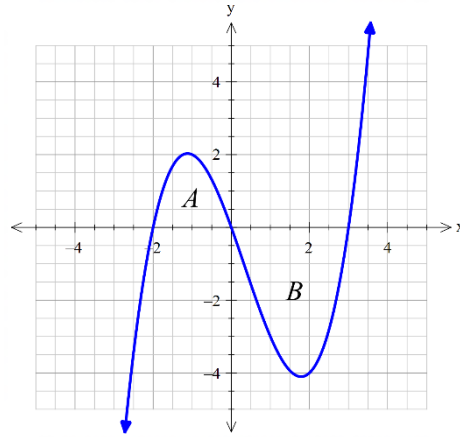
Determine each of the following

(a) $\int \frac{2-x^5}{x^3} dx$ [2]

(b) $\int_1^4 (2x+3) dx$ [2]

2. (9 marks)

Given the graph of $y = f(x)$ below where area $A = 7 \text{ cm}^2$ and area $B = 18 \text{ cm}^2$



(a) Determine

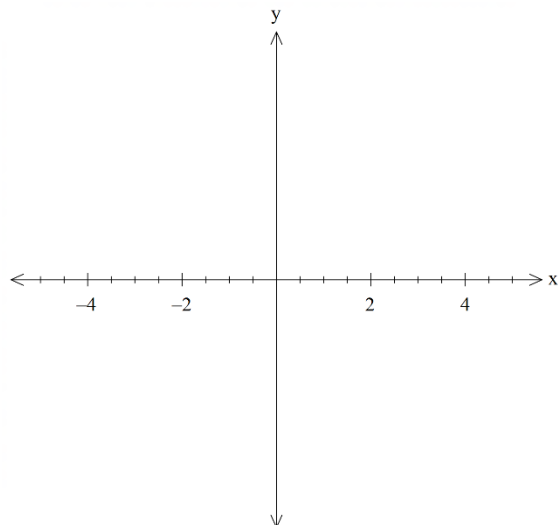
(i) $\int_{-2}^3 f(x) dx$ [1]

(ii) $\int_{-2}^3 |f(x)| dx$ [1]

(iii) $\int_{-2}^3 -f(x) dx$ [1]

(iv) $\int_{-2}^3 (f(x) + 2) dx$ [3]

(b) Sketch $y = f'(x)$ [2]



(c) Using your graph, determine when $f''(x) < 0$ [1]

3. (4 marks)

The gradient at any point on a curve is given by $\frac{dy}{dx} = \frac{1}{\sqrt{4-3x}}$. Determine the equation of the curve that passes through the point (-4,3).

4. (4 marks)

Given the function $y = x^2 + 1$

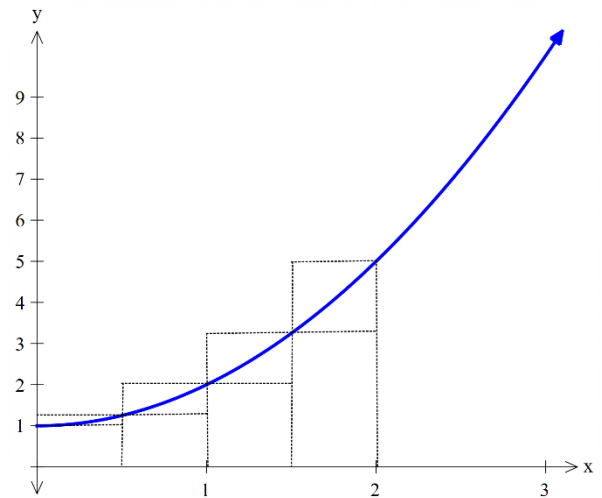
(a) Complete the table below.

[1]

0	0.5	1	1.5	2
	1.25		2.25	

(b) Calculate an underestimate of the area under the function for $0 \leq x \leq 2$ using 4 rectangles.

[2]



(c) The overestimate of the area under the function for $0 \leq x \leq 2$ is 5.25 using 4 rectangles.

Give a more accurate estimate of the area under the function for $0 \leq x \leq 2$ using 4 rectangles.

[1]

**Year 12 Methods Units 3,4
Test 1 2019**

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

STUDENT'S NAME _____

DATE: Friday 8th March

TIME: 30 minutes

MARKS: 32

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)

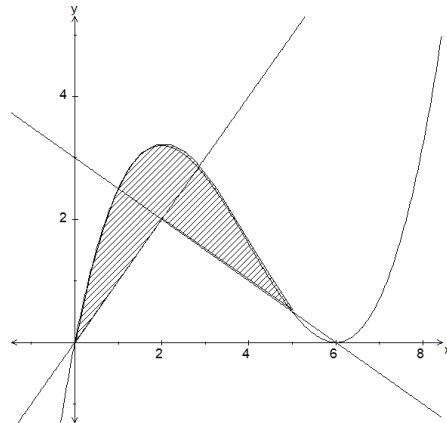
Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

5. (4 marks)

Newton's Law of Gravitation states that the force F of attraction between two particles having masses of m_1 and m_2 is given by $F = \frac{m_1 m_2 g}{s^2}$ where g is a constant and s is the distance between the two particles. If $s = 20 \text{ cm}$, use the increments formula to determine the approximate percentage change in s that will increase F by 8%.

6. (6 marks)

A new shape is being proposed for the boomerang throwing event in the 2032 Olympics being held in Perth. The cross-section (shaded) is formed by the intersection of three curves as shown.



The curves have equations $f(x) = 0.1x(x-6)^2$, $g(x) = x$ and $h(x) = 3 - 0.5x$. The scale used is in cm.

The boomerang is 3 mm thick and is made from a material which has a density of 8 g per cm^3 . Calculate the weight of the boomerang.

7. (4 marks)

The area enclosed by the curves $y = mx$ and $y = x^2$ is 24.813. Determine the value of m where $m > 0$.

8. (10 marks)

A particle travels in a straight line. Its velocity as it passes through a fixed point O is 2 ms^{-1} . The acceleration, t seconds after passing O, is given by $a = 6t - 6 \text{ ms}^{-2}$. Calculate

(a) the velocity after 2 seconds. [3]

(b) the maximum displacement for $0 \leq t \leq 2$. [3]

(c) the distance travelled in the first two seconds [2]

(d) the average velocity over the first 5 seconds [2]

9. (8 marks)

A consortium owns apartments. It discovers that if it charges \$400 per week it will rent out 240 apartments. For every \$5 increase in rent it will rent out 2 less apartments.

Determine

(a) Determine the number of apartments if there is a \$40 increase in rent [1]

(b) Determine the total rent collected from all apartments if the rental is increased to \$425 [2]

Let x be the number of \$5 increases in the rental amount.

(c) Show clearly the total rental collected from all rented apartments per week will be
$$R(x) = 96000 + 400x - 10x^2$$
 [3]

(d) Determine the number of apartments the consortium should rent out to maximise revenue and the apartment rental charged [2]