

(b) On the axes provided sketch the graph of $f(x)$, $-1 \leq x \leq 4$, labelling all key features. (4 marks)

(a) Use calculus to locate and classify all the stationary points of $f(x)$ and find any points of inflection. Let $f(x) = -x^3$. (6 marks)

Question 3 (10 marks)


Question 1 (3 marks)

Given that the function f has a rule of the form $f(x) = ax^2 + bx$ and $f(1) = 6$ and $f'(1) = 0$, find the values of a and b .

Total _____/21
20 Minutes

You may have a formula sheet for this section of the test.

Date: Friday 16th February 7.45am



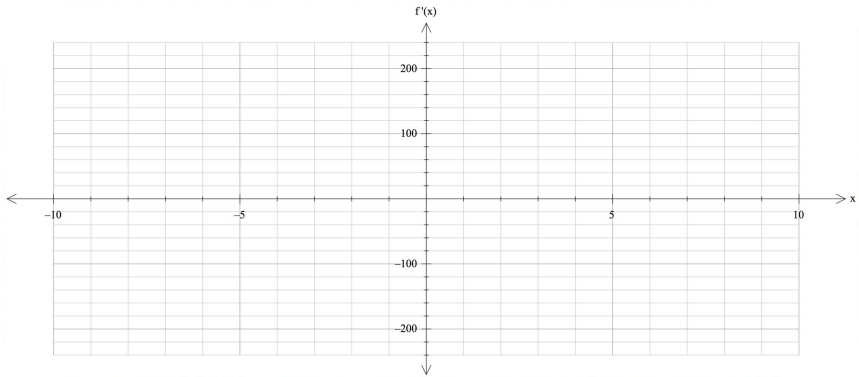
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Test 1
Differentiation, applications and Optimisation.
Basic antidifferentiation
Semester One 2018
Year 12 Mathematics Methods
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Question 2
 (8 marks)

Consider the gradient function $f'(x)=12x-2$.

- (a) Graph the gradient function
 (4 marks)



- (b) What kind of feature is at the point $(-5, -225)$ on the graph of $f(x)$?
 (2 marks)

- (c) What kind of feature is at the point $(-2, -144)$ on the graph of $f(x)$?
 (2 marks)

Question 2
 (6 marks)

A beverage company has decided to release a new product. "Modmash" is to be **sold** in 375 mL cans that are perfectly cylindrical. {Hint: $1\text{ mL}=1\text{ cm}^3$ }

- (a) If the cans have a base radius of $x\text{ cm}$ show that the surface area of the can, S , is given
 by: $S=2\pi x^2+\frac{750}{x}$.
 (2 marks)

- (b) Using calculus methods, and showing full reasoning and justification, find the dimensions of the can that will minimise its surface area
 (4 marks)

- (d) How far did the model train travel in the 8th second. (2 marks)
- (c) When is the model train at rest? (2 marks)

(b) Determine the value of the constant p . (4 marks)

The model train has an initial velocity of 5 cm/s . After 2 seconds, it has a displacement of -50 cm . A further 4 seconds later its displacement is 178 cm .

b) $\frac{1}{\sqrt{x+2}}$

- c) Consider the function $f(x)=|x-1|^2|x-2|+1$ (3 marks)

If $f'(x)=|x-1|(ux+v)$, where u and v are constants, use calculus to find the values of u and v .

Question 3 (6 marks)

Clearly showing your use of the product, quotient or chain rule differentiate the following.

(YOU MAY LEAVE YOUR ANSWERS IN UNSIMPLIFIED FORM)

- a) $10d^{\frac{1}{2}}$ (2 marks)

Question 4**(4 marks)**

The time T seconds, for one complete swing of a pendulum of length l m, is given by the rule $T = 2\pi\sqrt{\frac{l}{g}}$, where g is a constant.

(a) Determine $\frac{dT}{dl}$,

(2 marks)

(b) Using the formula $\partial T \approx \frac{dT}{dl} \times \partial l$, find the approximate increase in T when l is increased from 1.6 to 1.7. Give the answer in terms of g .

(2 marks)**Test 1**

Differentiation, applications and Optimisation.

Basic antidifferentiation

Semester One 2018**Year 12 Mathematics Methods****Calculator Assumed****Date: Friday 16th February 7.45am****You may have**

- a formula sheet
- one page of A4 notes, one side
- a scientific calculator
- a Classpad

Total _____/25**25 minutes****Question 1****(9 marks)**

A model train travels on a straight track such that its acceleration after t seconds is given by

$a(t) = pt - 13 \text{ cm/s}^2$, $0 \leq t \leq 10$, where p is a constant.

(a) Determine the initial acceleration of the model train.

(1 mark)