PERTH MODERN SCHOOL
Exceptional schooling. Exceptional students.

Test 1

Differentiaton , applications and Optimisation.

Basic antidifferentiation

Semester One 2018

Year 12 Mathematics Methods

Calculator Free

Date: Friday 16th February 7.45am

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

Total_____/21 **20 Minutes**

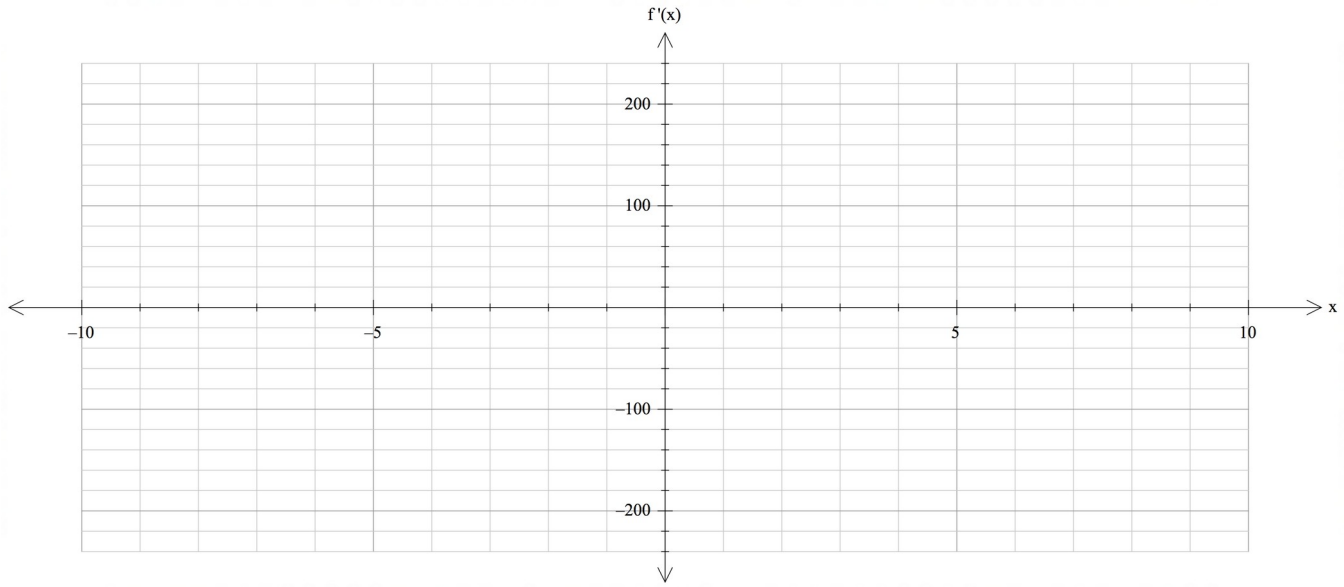
Question 1 **(3 marks)**

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.

Question 2 **(8 marks)**

Consider the gradient function $f'(x)=12$¿

(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 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) $10p¿$ (2 marks)

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

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 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)

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

(a) Determine the initial acceleration of the model train. (1 mark)

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

(c) When is the model train at rest? (2 marks)

(d) How far did the model train travel in the 8th second. (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: $1\,mL = 1\,cm^3$}

(a) If the cans have a base radius of $x\,cm$ 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)

Question 3 **(10 marks)**

Let $f(x) = -¿$.

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

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