Lesson 8

GCSE
Differentiation I

8.1 REVISION for the TEST

Marks Available : 64

Question 1

Write down the exact value of each of the following:

(i) 9^2 **(ii)** $(-2)^3$ **(iii)** $\left(\frac{1}{3}\right)^3$

(iv) $25^{\frac{1}{2}}$ **(v)** $27^{\frac{1}{3}}$ **(vi)** $(-1)^{18}$

(vii) $\left(\frac{2}{\pi}\right)^0$ **(viii)** 0^7 **(ix)** $\left(\frac{8}{11}\right)^2$

[9 marks]

Question 2

Consider the curve, $y = x^3 - 3x$

Write down the points on the curve that have the x part as given;

(i) (2, _____) **(ii)** (10, _____) **(iii)** (– 10, _____)

[3 marks]

Question 3

A quintic curve has equation, $y = 5x^5 - 7x^3$

(i) Write down the gradient equation of the polynomial curve

[2 marks]

(ii) Write down the bend detector equation of the polynomial curve

[1 mark]

(iii) Use the appropriate equation to find the point on the curve when $x = 1$

[1 mark]

(iv) Use the appropriate equation to find the gradient of the curve when $x = 1$

[1 mark]

(v) Determine, when $x = 1$, if the curve is bending anticlockwise or clockwise

[2 marks]

Question 4

Write down the exact value of the following:

(i) 4^{-2} **(ii)** $8^{\frac{2}{3}}$

[2 marks]

Question 5

A curve has equation, $y = x^3 - 3x$

(i) Find $\frac{dy}{dx}$

[2 marks]

(ii) Find the gradient of the curve at the point where $x = -4$

[1 mark]

(iii) The curve has two turning points.
Find the coordinates of the two turning points.

[4 marks]

Question 6

Differentiate the following;

(i) $y = 5x^{-3}$

[2 marks]

(ii) $y = (5x + 3)^2$

[3 marks]

Some Theory of Mechanics

Starting with a displacement, s

Differentiate the displacement to get the velocity...

$$velocity = \frac{ds}{dt}$$

Differentiate the velocity to get the acceleration...

$$acceleration = \frac{d^2s}{dt^2}$$

Question 7

GCSE Examination question from May 2008, 4H, Q19

A particle moves in a straight line through a fixed point *O*.

The displacement of the particle from *O* at time *t* seconds is *s* metres, where

$$s = t^2 - 6t + 10$$

(a) Find $\frac{ds}{dt}$

[2 marks]

(b) Find the velocity of the particle when $t = 5$

[2 marks]

(c) Find the acceleration of the particle.

[2 marks]

Question 8

GCSE Examination question from November 2007, 4H, Q20.

A curve has equation, $y = x^3 - 5x^2 + 8x - 7$

(a) Find the gradient of the curve at $(2, -3)$

[4 marks]

(b) What does your answer to part (a) tell you about the point $(2, -3)$?

[1 mark]

Question 9

(i) Find the gradient equation of the curve,

$$y = \frac{16}{x^3}$$

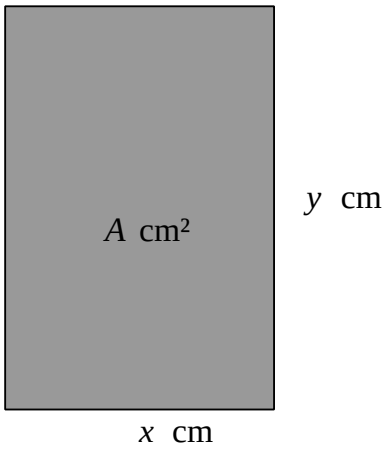
[3 marks]

(ii) Find the gradient of the curve when $x = -2$

[2 marks]

Question 10

GCSE Examination question from January 2012, 3H, Q14



The diagram shows a rectangular photo frame of area A cm^2
The width of the photo frame is x cm
The height of the photo frame is y cm
The perimeter of the photo frame is 72 cm

(a) Show that $A = 36x - x^2$

[3 marks]

(b) Find $\frac{dA}{dx}$

[2 marks]

(c) Find the maximum value of A

[3 marks]

Question 11

GCSE Examination question from November 2009, 4H, Q19.

A particle moves in a straight line through a fixed point *O*.
The displacement, *s* metres, of the particle from *O* at time *t* seconds is given by

$$s = t^3 - 5t^2 + 8$$

(a) Find an expression for the velocity, *v* ms^{-1}, of the particle after *t* seconds.

[2 marks]

(b) Find the time at which the acceleration of the particle is 20 ms^{-2}

[2 marks]

Question 12

Find the derivative of, $y = 18\sqrt{x}$

[3 marks]