Lesson 9

GCSE Mathematics
Differentiation I

9.1 Homework REVISION for the TEST

Marks Available : 64

Question 1

Write down the exact value of each of the following:

(i) 12^2 **(ii)** $(-4)^3$ **(iii)** $\left(\frac{1}{5}\right)^3$

(iv) $100^{\frac{1}{2}}$ **(v)** $64^{\frac{1}{3}}$ **(vi)** $(-1)^{51}$

(vii) $\left(\frac{\sqrt{7\sin(60)}}{\pi}\right)^0$ **(viii)** $0^{0.5}$ **(ix)** $\left(\frac{4}{9}\right)^2$

[9 marks]

Question 2

Consider the curve, $y = x^3 - 5x$

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

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

[3 marks]

Question 3

Consider the heptic equation, $y = 5x^6 - 7x^4$

(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) 7^{-2} **(ii)** $16^{\frac{3}{2}}$

[2 marks]

Question 5

A curve has equation, $y = x^3 - 12x$

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

[2 marks]

(ii) Find the gradient of the curve at the point where $x = -3$

[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) $y = 5x^{-2}$

[2 marks]

(ii) $y = (7x + 3)^2$

[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

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

$$s = t^2 - 9t + 13$$

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

[2 marks]

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

[2 marks]

(c) Find the acceleration of the particle.

[2 marks]

Question 8

A curve has equation, $y = x^3 - 8x^2 + 21x - 21$

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

[4 marks]

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

[1 mark]

Question 9

(i) Find the gradient equation of the curve,

$$y = \frac{16}{x^4}$$

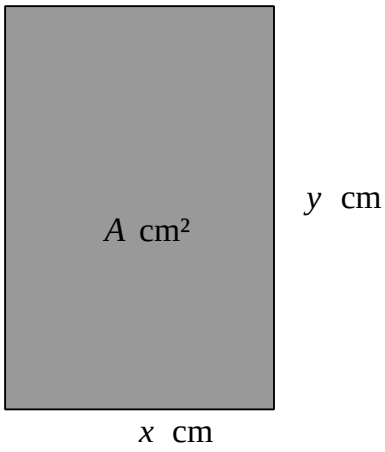
[3 marks]

(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 84 cm

(a) Show that $A = 42x - x^2$

[3 marks]

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

[2 marks]

(c) Find the maximum value of A.

[3 marks]

Question 11

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

$$s = t^3 - 3t^2 - 2t + 12$$

(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 30 ms^{-2}

[2 marks]

Question 12

Find the derivative of,

$$y = 24\sqrt{x}$$

[3 marks]