DIFFERENTIATION

$$\frac{dy}{dx}$$

D I F F E R E N T I A T I O N
The Basics and Applications

Lesson 1

1.1 Indices

The mathematical topic of differentiation is about the gradient of curves. It is built upon the assumption that the topic of indices has been thoroughly mastered and so, by way of preparation, this lesson will revise the necessary background material.

Without using a calculator, determine the value of each of the following.
Give exact answers by using vulgar fractions where it is helpful to do so.

(i) $\left(\dfrac{3}{7} \right)^2$ 　　　　　 (ii) 3^{-2} 　　　　　 (iii) π^0

(iv) $\left(\dfrac{3}{2} \right)^{-3}$ 　　　　 (v) $\sqrt{\left(\dfrac{16}{9} \right)}$ 　　　　 (vi) 0.125^2

(vii) $\left(\dfrac{1}{2} \right)^{-5}$ 　　　　 (viii) $16^{\frac{1}{2}}$ 　　　　 (ix) $8^{\frac{2}{3}}$

[9 marks]

Now watching the teaching video to see if your answers are correct.

Teaching Video : http://www.NumberWonder.co.uk/v9036/1.mp4

1.2 A Useful "Flip"

Power Inversion Rule

$$\left(\frac{p}{q} \right)^{-m} = \left(\frac{q}{p} \right)^{m} \qquad p,\ q \neq 0$$

1.3 Exercise

Marks Available : 76

Question 1

Without using a calculator, determine the value of each of the following.
You may leave answers as vulgar fractions where it is helpful to do so.

(i) 4^2 (ii) 2^8 (iii) 7^1

(iv) $\left(\dfrac{1}{2}\right)^5$ (v) $\left(\dfrac{2}{5}\right)^3$ (vi) 0.25^2

(vii) $\sqrt{36}$ (viii) 14^0 (ix) $81^{\frac{1}{2}}$

(x) $25^{\frac{1}{2}}$ (xi) $125^{\frac{1}{3}}$ (xii) $\left(\dfrac{9}{4}\right)^{\frac{1}{2}}$

(xiii) $6^2 + 8^2$ (xiv) $10^3 \times 13^2$ (xv) 7^{-2}

(xvi) $\sqrt{\dfrac{1}{3^2 + 4^2}}$ (xvii) $\left(\dfrac{\pi}{1 + \sqrt{\frac{1}{\pi}}}\right)^0$ (xviii) $4^{\frac{3}{2}}$

(xix) $8^{\frac{2}{3}}$ (xx) 2^{-3} (xxi) $\left(\dfrac{1}{3}\right)^2$

(xxii) $\left(\dfrac{3}{7}\right)^{-1}$ (xxiii) 0.1^2 (xxiv) $\sqrt{\sqrt{256}}$

(xxv) $\left(\dfrac{3}{10}\right)^3$ (xxvi) $27^{\frac{2}{3}}$

[26 marks]

Question 2

Without using a calculator, determine the value of each of the following.
You may leave answers as vulgar fractions where it is helpful to do so.

(i) $(-3)^2$ (ii) 2^7 (iii) $\left(\dfrac{1}{20}\right)^3$

(iv) $\left(-\dfrac{1}{2}\right)^4$ (v) $\left(\dfrac{3}{5}\right)^{-3}$ (vi) $400^{\frac{1}{2}}$

(vii) $(-1)^{42}$ (viii) $(-2)^3$ (ix) $169^{\frac{1}{2}}$

(x) $81^{0.5}$ (xi) $64^{\frac{1}{3}}$ (xii) $\left(\dfrac{1}{25}\right)^{\frac{1}{2}}$

(xiii) $9^2 + 12^2$ (xiv) $10^4 \times 14^2$ (xv) $\sqrt{\dfrac{1}{12^2 + 5^2}}$

(xvi) $1^{-0.5}$ (xvii) $\left(\dfrac{sin\,(4\pi)}{cos\,(2\pi)\,+\,\sqrt{\frac{1}{\pi}}}\right)^0$

(xviii) $9^{\frac{3}{2}}$ (xix) $(-8)^{\frac{2}{3}}$ (xx) 2^{-5}

(xxi) $\left(-\dfrac{5}{6}\right)^{-2}$ (xxii) $\left(\dfrac{4}{9}\right)^{\frac{1}{2}}$ (xxiii) $\left(\dfrac{1}{100}\right)^3$

(xxiv) $\sqrt{\sqrt{81}}$ (xxv) $\left(-\dfrac{10}{3}\right)^2$ (xxvi) $125^{\frac{2}{3}}$

[26 marks]

Question 3

Without using a calculator, for the curve with equation

$$y = x^2 + x$$

write down points on the curve with the x values given.

(1, _____)   (4, _____)   (100, _____)   (− 1, _____)

[4 marks]

Question 4

Without using a calculator, for the curve with equation;

$$y = x^3 - 5$$

write down points on the curve with the x values given.

(0, _____)   (1, _____)   (− 1, _____)   (5, _____)

[4 marks]

Question 5

Without using a calculator, for the curve with equation

$$y = x^{\frac{3}{2}} + 3$$

write down points on the curve with the x values given.

(0, _____)   (1, _____)   (4, _____)   (9, _____)

[4 marks]

Question 6

Without using a calculator, for the curve with equation

$$y = 2 + x^{-1}$$

write down points on the curve with the x values given.

(1, _____)   (− 1 , _____)   (2, _____)   (10, _____)

[4 marks]

Question 7

Without using a calculator, for the curve with equation

$$y = x^2 + x^{\frac{1}{2}}$$

write down points on the curve with the x values given.

(1, ____)   (4, ____)   (100, ____) $\left(\dfrac{1}{4}, \underline{\quad} \right)$

[4 marks]

Question 8

Without using a calculator, for the curve with equation

$$y = x^3 + 4x^2$$

write down points on the curve with the x or y values given.

(1, _____)   (3, _____)   (0, _____)   (– 1, _____)

[4 marks]