AQA – Differentiation – AS Mathematics P1

1. June/2020/Paper_1/No.5

Differentiate from first principles

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

[4 marks]

2. June/2020/Paper_1/No.8

(a) Find the equation of the tangent to the curve $y = e^{4x}$ at the point (a, e^{4a}).

[3 marks]

(b) Find the value of a for which this tangent passes through the origin.

[2 marks]

(c) Hence, find the set of values of m for which the equation

$$e^{4x} = mx$$

has no real solutions.

[3 marks]

3. June/2019/Paper_1/No.8

Prove that the curve with equation

$$y = 2x^5 + 5x^4 + 10x^3 - 8$$

has **only one** stationary point, stating its coordinates.

[6 marks]

4. June/2019/Paper_1/No.9

A curve cuts the x-axis at (2, 0) and has gradient function

$$\frac{dy}{dx} = \frac{24}{x^3}$$

(a) Find the equation of the curve.

[4 marks]

(b) Show that the perpendicular bisector of the line joining $A(-2, 8)$ to $B(-6, -4)$ is the normal to the curve at $(2, 0)$

[6 marks]

5. June/2019/Paper_1/No.10

On 18 March 2019 there were 12 hours of daylight in Inverness.

On 16 June 2019, 90 days later, there will be 18 hours of daylight in Inverness.

Jude decides to model the number of hours of daylight in Inverness, N, by the formula

$$N = A + B\sin t°$$

where t is the number of days after 18 March 2019.

(a) (i) State the value that Jude should use for A.

[1 mark]

(a) (ii) State the value that Jude should use for B.

[1 mark]

(a) (iii) Using Jude's model, calculate the number of hours of daylight in Inverness on 15 May 2019, 58 days after 18 March 2019.

[1 mark]

(a) (iv) Using Jude's model, find how many days during 2019 will have at least 17.4 hours of daylight in Inverness.

[4 marks]

(a) (v) Explain why Jude's model will become inaccurate for 2020 and future years.

[1 mark]

(b) Anisa decides to model the number of hours of daylight in Inverness with the formula

$$N = A + B\sin\left(\frac{360}{365}t\right)^\circ$$

Explain why Anisa's model is better than Jude's model.

[1 mark]