1 The gradient of a curve is given by $\frac{dy}{dx} = 4x + 3$. The curve passes through the point $(2, 9)$.

(i) Find the equation of the tangent to the curve at the point $(2, 9)$. **[3]**

(ii) Find the equation of the curve and the coordinates of its points of intersection with the x-axis. Find also the coordinates of the minimum point of this curve. **[7]**

(iii) Find the equation of the curve after it has been stretched parallel to the x-axis with scale factor $\frac{1}{2}$. Write down the coordinates of the minimum point of the transformed curve. **[3]**

2 Find the equation of the normal to the curve $y = 8x^4 + 4$ at the point where $x = \frac{1}{2}$. **[5]**

3 **(i)** Find the equation of the tangent to the curve $y = x^4$ at the point where $x = 2$. Give your answer in the form $y = mx + c$. **[4]**

(ii) Calculate the gradient of the chord joining the points on the curve $y = x^4$ where $x = 2$ and $x = 2.1$. **[2]**

(iii) (A) Expand $(2 + h)^4$. **[3]**

(B) Simplify $\frac{(2 + h)^4 - 2^4}{h}$. **[2]**

(C) Show how your result in part **(iii)** (B) can be used to find the gradient of $y = x^4$ at the point where $x = 2$. **[2]**

4 **(i)** Calculate the gradient of the chord joining the points on the curve $y = x^2 - 7$ for which $x = 3$ and $x = 3.1$. **[2]**

(ii) Given that $f(x) = x^2 - 7$, find and simplify $\dfrac{f(3+h) - f(3)}{h}$. **[3]**

(iii) Use your result in part **(ii)** to find the gradient of $y = x^2 - 7$ at the point where $x = 3$, showing your reasoning. **[2]**

(iv) Find the equation of the tangent to the curve $y = x^2 - 7$ at the point where $x = 3$. **[2]**

(v) This tangent crosses the x-axis at the point P. The curve crosses the positive x-axis at the point Q. Find the distance PQ, giving your answer correct to 3 decimal places. **[3]**

5 In Fig. 5, A and B are the points on the curve $y = 2^x$ with x-coordinates 3 and 3.1 respectively.

Not to scale

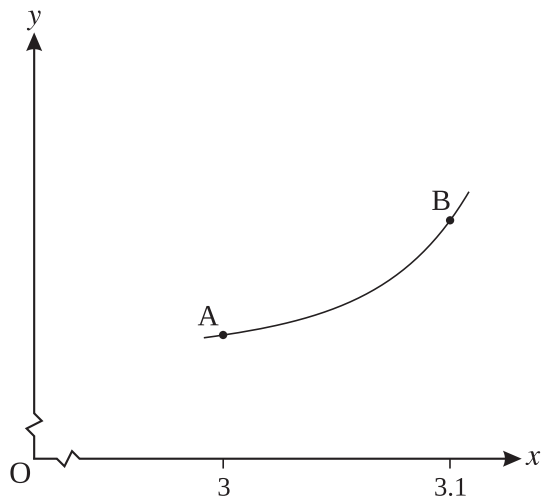

Fig. 5

(i) Find the gradient of the chord AB. Give your answer correct to 2 decimal places. [2]

(ii) Stating the points you use, find the gradient of another chord which will give a closer approximation to the gradient of the tangent to $y = 2^x$ at A. [2]