The equation of the curve shown in Fig. 11 is \( y = x^3 - 6x + 2 \).

(i) Find \( \frac{dy}{dx} \). \[2\]

(ii) Find, in exact form, the range of values of \( x \) for which \( x^3 - 6x + 2 \) is a decreasing function. \[3\]

(iii) Find the equation of the tangent to the curve at the point \((-1, 7)\).

Find also the coordinates of the point where this tangent crosses the curve again. \[6\]
2  Find \( \frac{dy}{dx} \) when \( y = x^6 + \sqrt{x} \). [3]

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 \( \frac{f(3 + h) - f(3)}{h} \). [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]
Fig. 12 shows part of the curve $y = x^4$ and the line $y = 8x$, which intersect at the origin and the point P.

(A) Find the coordinates of P, and show that the area of triangle OPQ is 16 square units. [3]

(B) Find the area of the region bounded by the line and the curve. [3]

(ii) You are given that $f(x) = x^4$.

(A) Complete this identity for $f(x + h)$.

\[ f(x + h) = (x + h)^4 = x^4 + 4x^3h + \ldots \] [2]

(B) Simplify \( \frac{f(x + h) - f(x)}{h} \). [2]

(C) Find \( \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} \). [1]

(D) State what this limit represents. [1]