Differentiation (answers at the end)

1 Find the equation of the tangent to $y = 5x^2 - 7x + 4$ at the point (2, 10).

2 Given the function $f(x) = x^3 + 5x^2 - x - 4$, find

(a) $f'(-2)$ (b) the values of a such that $f'(a) = 56$.

3 Find the equation of the normal to $y = x^4 - 4x^3$ at the point for which $x = \frac{1}{2}$.

4 Find the equation of the tangent at $x = 3$ to the curve with equation $y = 2x^2 - 3x + 2$.

5 Find the point on the curve $y = 2x^2 - 3x + 1$ where the tangent has gradient 1.

6 Find the two points on the curve $y = 2x^3 - 5x^2 + 9x - 1$ at which the gradient is 13.

7 Find the equation of the normal to $y = (2x - 1)(3x + 5)$ at the point (1, 8). Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

8 The curve $y = x^2 - 3x - 4$ crosses the x-axis at P and Q. The tangents to the curve at P and Q meet at R. The normals to the curve at P and Q meet at S. Find the distance RS.

9 The equation of a curve is $y = 2x^2 - 5x + 14$. The normal to the curve at the point (1, 11) meets the curve again at the point P. Find the coordinates of P.

10 The line $y = 6x - 7$ is a tangent to the curve $y = x^2 + k$. Find k.

11 At a particular point of the curve $y = 5x^2 - 12x + 1$ the equation of the normal is $x + 18y + c = 0$. Find the value of the constant c.

12 A normal to the curve $y = x^2$ has gradient 2. Find where it meets the curve.

1 $y = 13x - 16$

2 (a) -9 (b) $a = -\frac{19}{3}$, 3

3 $80y = 32x - 51$

4 $9x - y = 16$

5 (1, 0)

6 $(-\frac{1}{3}, -4\frac{17}{27})$, (2, 13)

7 $x + 19y - 153 = 0$

8 13

9 (2, 12)

10 $k = 2$

11 -183

12 $(-\frac{1}{4}, \frac{1}{16})$, $(2\frac{1}{4}, 5\frac{1}{16})$