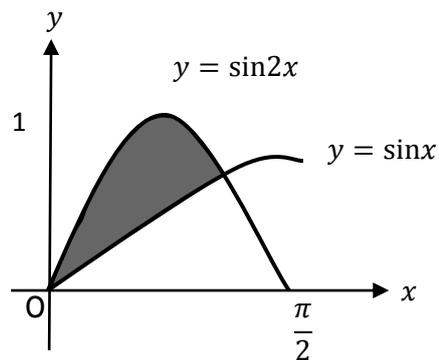**Integration and the addition formula**

1. **a)** Write down a formula for $\sin 2x$, and use it to solve the equation $\sin 2x = \sin x$ for $0 \leq x \leq \frac{\pi}{2}$.

    **b)** Find the shaded area enclosed by the curves $y = \sin 2x$ and $y = \sin x$.
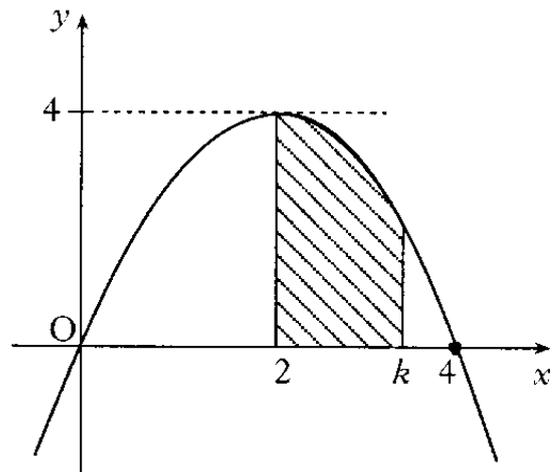


**Integration and quadratic graphs**

2.     The parabola shown crosses the $x$-axis at $(0, 0)$ and $(4, 0)$, and has a maximum at $(2, 4)$.

       The shaded area is bound by the parabola, the $x$-axis and the lines $x = 2$ and $x = k$.

    (a) Find the equation of the parabola.

    (b) Hence show that the shaded area, $A$, is given by

$$A = -\frac{1}{3}k^3 + 2k^2 - \frac{16}{3}.$$

**Integration and the wave function**

3.  **(a)** The expression $3 \sin x - 5 \cos x$ can be written in the form $R \sin(x + a)$ where $R > 0$ and $0 \le a \le 2\pi$.
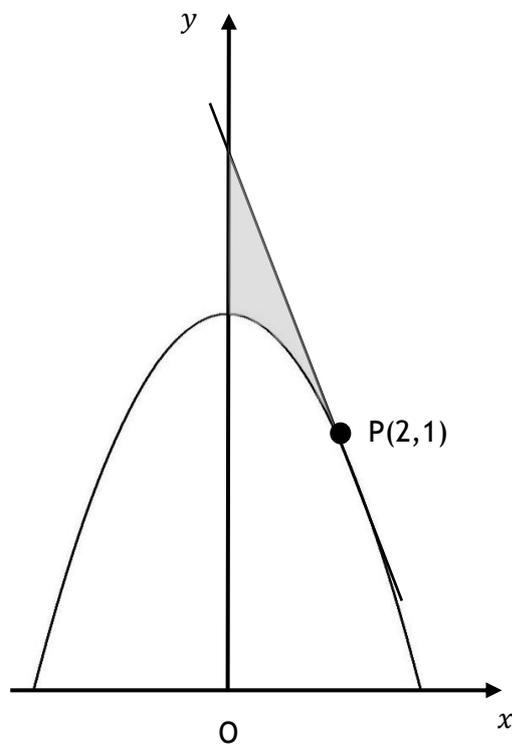
    Calculate the values of $R$ and $a$.

    **(b)** Hence find the value of $t$, where $0 \le t \le 2$, for which

    $$\int_0^t (3 \sin x - 5 \cos x) \, dx = 3$$

**Integration and Differentiation**

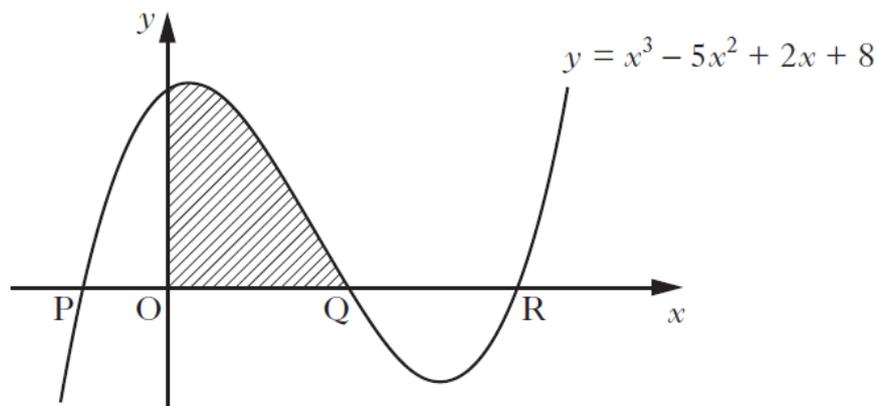4.  **(a)** Find the equation of the tangent to the parabola $y = 5 - x^2$ at P(2,1)

    **(b)** Calculate the area of the shaded region bounded by the tangent, the parabola and the y axis.

**Integration and polynomials**

5.　(a)　(i)　Show that $(x - 4)$ is a factor of $x^3 - 5x^2 + 2x + 8$.

　　　(ii)　Factorise $x^3 - 5x^2 + 2x + 8$ fully.

　　　(iii)　Solve $x^3 - 5x^2 + 2x + 8 = 0$.

　(b)　The diagram shows the curve with equation $y = x^3 - 5x^2 + 2x + 8$



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

The curve crosses the $x$-axis at $P$, $Q$ and $R$.

Determine the shade area.