

1 Integrate with respect to x

a x^2 **b** x^6 **c** x **d** x^{-4} **e** 5 **f** $3x^2$
g $4x^7$ **h** $6x^{-2}$ **i** $8x^5$ **j** $\frac{1}{3}x$ **k** $2x^{-9}$ **l** $\frac{3}{4}x^{-3}$

2 Find

a $\int (2x + 3) dx$ **b** $\int (12x^3 - 4x) dx$ **c** $\int (7 - x^2) dx$ **d** $\int (x^2 + x + 1) dx$
e $\int (x^4 + 5x^2) dx$ **f** $\int x(x^2 - 3) dx$ **g** $\int (x - 2)^2 dx$ **h** $\int (3x^4 + x^2 - 6) dx$
i $\int (2 + \frac{1}{x^2}) dx$ **j** $\int (x - \frac{1}{x^3}) dx$ **k** $\int x^2(\frac{2}{x^4} - 3) dx$ **l** $\int (x - \frac{4}{x})^2 dx$

3 Integrate with respect to y

a $y^{\frac{1}{2}}$ **b** $y^{\frac{5}{2}}$ **c** $y^{-\frac{1}{2}}$ **d** $4y^{\frac{1}{3}}$ **e** $y^{\frac{3}{4}}$ **f** $5y^{-\frac{2}{3}}$
g $\sqrt[4]{y}$ **h** $\frac{7}{\sqrt{y}}$ **i** $\frac{1}{2y^2}$ **j** $\sqrt{y^3}$ **k** $\frac{5}{2y^4}$ **l** $\frac{1}{3\sqrt{y}}$

4 Find

a $\int (3t^{\frac{1}{2}} - 1) dt$ **b** $\int (2r + \sqrt{r}) dr$ **c** $\int (3p - 1)^2 dp$ **d** $\int (4x + x^{\frac{1}{3}}) dx$
e $\int (\frac{1}{y^3} + y) dy$ **f** $\int (\frac{1}{2}x^2 - x^{\frac{3}{2}}) dx$ **g** $\int \frac{t^3 + 2t}{t} dt$ **h** $\int (r^{\frac{5}{3}} - r^{\frac{2}{3}}) dr$
i $\int \frac{4p^4 - p^2}{2p} dp$ **j** $\int (4 - y^{\frac{7}{4}}) dy$ **k** $\int \frac{1 + 6x^2}{3x^2} dx$ **l** $\int \frac{2t + 3}{\sqrt{t}} dt$

5 Find $\int y dx$ when

a $y = 3x^2 - x + 6$ **b** $y = x^6 - x^3 + 2x - 5$ **c** $y = x(x - 2)(x + 1)$
d $y = (x^{\frac{1}{2}} + 2)^2$ **e** $y = (x^2 - 4)(2x + 3)$ **f** $y = x^3 - 2x^{\frac{4}{3}} + \frac{7}{x^2}$
g $y = \frac{1}{4x^3} - \frac{2}{3x^2}$ **h** $y = (1 - \frac{2}{x^2})^2$ **i** $y = (x^{\frac{5}{2}} - 1)(x^{\frac{3}{2}} + 1)$

6 Find a general expression for y given that

a $\frac{dy}{dx} = 8x + 3$ **b** $\frac{dy}{dx} = \frac{1}{2}x^3 - x^2$ **c** $\frac{dy}{dx} = \frac{4}{3x^3}$
d $\frac{dy}{dx} = (x + 1)^3$ **e** $\frac{dy}{dx} = 2x - \frac{3}{\sqrt{x}}$ **f** $\frac{dy}{dx} = x^{\frac{3}{2}} - 2x^{-\frac{3}{2}}$
g $\frac{dy}{dx} = \frac{3 - x^2}{2x^2}$ **h** $\frac{dy}{dx} = \frac{2}{x^3}(5 - x)$ **i** $\frac{dy}{dx} = \frac{9x - 2}{3\sqrt{x}}$

- 1 a Find $\int (2x + 1) dx$.
- b Given that $\frac{dy}{dx} = 2x + 1$ and that $y = 5$ when $x = 1$, find an expression for y in terms of x .
- 2 Use the given boundary conditions to find an expression for y in each case.

a $\frac{dy}{dx} = 3 - 6x$, $y = 1$ at $x = 2$ b $\frac{dy}{dx} = 3x^2 - x$, $y = 41$ at $x = 4$

c $\frac{dy}{dx} = x^2 + 4x + 1$, $y = 4$ at $x = -3$ d $\frac{dy}{dx} = 7 - 5x - x^3$, $y = 0$ at $x = 2$

e $\frac{dy}{dx} = 8x - \frac{2}{x^2}$, $y = -1$ at $x = \frac{1}{2}$ f $\frac{dy}{dx} = 3 - \sqrt{x}$, $y = 8$ at $x = 4$

- 3 The curve $y = f(x)$ passes through the point $(3, 5)$.
Given that $f'(x) = 3 + 2x - x^2$, find an expression for $f(x)$.

- 4 Given that

$$\frac{dy}{dx} = 10x^{\frac{3}{2}} - 2x^{-\frac{1}{2}},$$

and that $y = 7$ when $x = 0$, find the value of y when $x = 4$.

- 5 The curve $y = f(x)$ passes through the point $(-1, 4)$. Given that $f'(x) = 2x^3 - x - 8$,
- a find an expression for $f(x)$,
- b find an equation of the tangent to the curve at the point on the curve with x -coordinate 2.

- 6 The curve $y = f(x)$ passes through the origin.

Given that $f'(x) = 3x^2 - 8x - 5$, find the coordinates of the other points where the curve crosses the x -axis.

- 7 Given that

$$\frac{dy}{dx} = 3x + \frac{2}{x^2},$$

- a find an expression for y in terms of x .

Given also that $y = 8$ when $x = 2$,

- b find the value of y when $x = \frac{1}{2}$.

- 8 The curve C with equation $y = f(x)$ is such that

$$\frac{dy}{dx} = 3x^2 + kx,$$

where k is a constant.

Given that C passes through the points $(1, 6)$ and $(2, 1)$,

- a find the value of k ,

- b find an equation of the curve.