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 $\int (2x+3)\ \mathrm{d}x$ **b** $\int (12x^3-4x)\ \mathrm{d}x$ **c** $\int (7-x^2)\ \mathrm{d}x$ **d** $\int (x^2+x+1)\ \mathrm{d}x$

   e $\int (x^4+5x^2)\ \mathrm{d}x$ **f** $\int x(x^2-3)\ \mathrm{d}x$ **g** $\int (x-2)^2\ \mathrm{d}x$ **h** $\int (3x^4+x^2-6)\ \mathrm{d}x$

   i $\int (2+\frac{1}{x^2})\ \mathrm{d}x$ **j** $\int (x-\frac{1}{x^3})\ \mathrm{d}x$ **k** $\int x^2(\frac{2}{x^4}-3)\ \mathrm{d}x$ **l** $\int (x-\frac{4}{x})^2\ \mathrm{d}x$

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** $\dfrac{7}{\sqrt{y}}$ **i** $\dfrac{1}{2y^2}$ **j** $\sqrt{y^3}$ **k** $\dfrac{5}{2y^4}$ **l** $\dfrac{1}{3\sqrt{y}}$
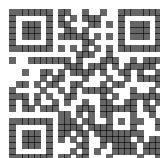
4   Find

   a $\int (3t^{\frac{1}{2}}-1)\ \mathrm{d}t$ **b** $\int (2r+\sqrt{r})\ \mathrm{d}r$ **c** $\int (3p-1)^2\ \mathrm{d}p$ **d** $\int (4x+x^{\frac{1}{3}})\ \mathrm{d}x$

   e $\int (\frac{1}{y^3}+y)\ \mathrm{d}y$ **f** $\int (\frac{1}{2}x^2-x^{\frac{3}{2}})\ \mathrm{d}x$ **g** $\int \frac{t^3+2t}{t}\ \mathrm{d}t$ **h** $\int (r^{\frac{5}{3}}-r^{\frac{2}{3}})\ \mathrm{d}r$

   i $\int \frac{4p^4-p^2}{2p}\ \mathrm{d}p$ **j** $\int (4-y^{\frac{7}{4}})\ \mathrm{d}y$ **k** $\int \frac{1+6x^2}{3x^2}\ \mathrm{d}x$ **l** $\int \frac{2t+3}{\sqrt{t}}\ \mathrm{d}t$

5   Find $\int y\ \mathrm{d}x$ 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 $\dfrac{\mathrm{d}y}{\mathrm{d}x}=8x+3$ **b** $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\frac{1}{2}x^3-x^2$ **c** $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{4}{3x^3}$

   d $\dfrac{\mathrm{d}y}{\mathrm{d}x}=(x+1)^3$ **e** $\dfrac{\mathrm{d}y}{\mathrm{d}x}=2x-\dfrac{3}{\sqrt{x}}$ **f** $\dfrac{\mathrm{d}y}{\mathrm{d}x}=x^{\frac{3}{2}}-2x^{-\frac{3}{2}}$

   g $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{3-x^2}{2x^2}$ **h** $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{2}{x^3}(5-x)$ **i** $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{9x-2}{3\sqrt{x}}$

1 **a** Find $\int (2x + 1) \, dx$.

b Given that $\dfrac{dy}{dx} = 2x + 1$ 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 $\dfrac{dy}{dx} = 3 - 6x$, $y = 1$ at $x = 2$ **b** $\dfrac{dy}{dx} = 3x^2 - x$, $y = 41$ at $x = 4$

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

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