**3** Evaluate the following:

**(a)** $\int_{-1}^{2} 3x(2-x)\,dx$ **(b)** $4\int_{-3}^{-1} x(x+1)^2\,dx$ **(c)** $\int_{-2}^{4}\left(x^3-2\right)dx$

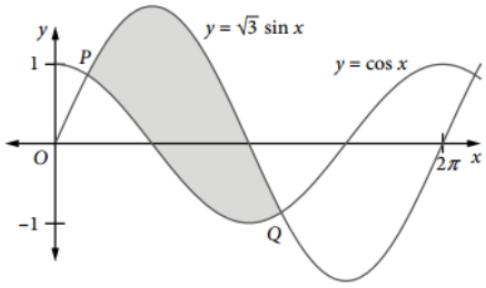
**7** Evaluate: **(a)** $\int_{\frac{\pi}{8}}^{\frac{\pi}{4}} (\sin 2x - \cos 2x)\,dx$ **(b)** $\int_{0}^{\frac{\pi}{2}} (\cos 2x - x)\,dx$ **(c)** $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sec^2 x}{\tan x}\,dx$

**17** Evaluate: **(a)** $\int_{-2}^{2}\left(e^{x}-e^{-x}\right)dx$ **(b)** $\int_{-1}^{2}\left(e^{x}-e^{-x}\right)^{2}dx$ **(c)** $\int_{1}^{3}\left(e^{x}+\frac{1}{x}\right)dx$

**21** The diagram shows the graphs of $y = \sqrt{3}\sin x$ and $y = \cos x$. The first two points of intersection to the right of the $y$-axis are labelled $P$ and $Q$.

**(a)** Solve the equation $\sqrt{3}\sin x = \cos x$ to find the abscissae of $P$ and $Q$.

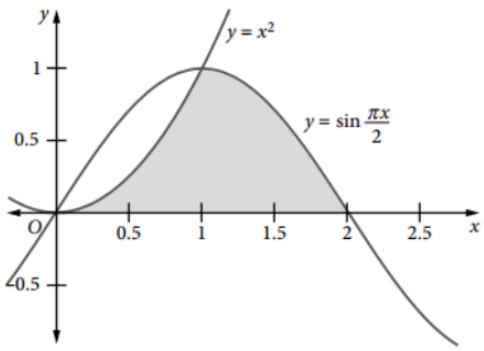
**(b)** Find the area of the shaded region in the diagram.



**23** The shaded region in the diagram is bounded by the curves $y = \sin\frac{\pi x}{2}$, $y = x^2$ and the $x$-axis.

**(a)** Show that the two curves meet at $x = 1$.

**(b)** Calculate the exact area of the shaded region.



**26** The velocity $v\ \text{m s}^{-1}$ of a particle moving in a straight line is given by $v = 6t^2 - 4t + 1$ $(t \geq 0)$. The particle initially has a displacement $-10$ m from $O$. Find:

**(a)** the displacement and acceleration at any time $t$

**(b)** the acceleration when the velocity is $3\ \text{m s}^{-1}$

**(c)** the velocity when the acceleration is $20\ \text{m s}^{-2}$.

**27** A full water tank holds 4000 litres. When the tap is turned on, water flows out from the tank at a rate of $\frac{dV}{dt} = 110 + 17t - t^2$ litres per minute, where $t$ is the time in minutes since the tap was turned on.

**(a)** At what time is the tank emptying at a rate of 50 litres per minute?

**(b)** Find the volume of water that has flowed out of the since the tap was turned on as a function of $t$.

**(c)** How much water has flowed out of the tank 12 minutes after the tap was turned on?

**(d)** When does the water stop flowing out of the tank?

**(e)** How much water is left in the tank (to the nearest litre) when the water stops flowing out of the tank?

**29** **(a)** Sketch the graphs of $y = 2^x$ and $y = 3^{-x}$ over the domain $-1 \leq x \leq 2$.

**(b)** Calculate the area of the region bounded by the curves $y = 2^x$, $y = 3^{-x}$ and the ordinates $x = -1$ and $x = 2$.