Review exercise 2

1 The equation of the line is:

$$\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}$$

$$\frac{y-8}{6-8}=\frac{x-(-2)}{4-(-2)}$$

$$\frac{y-8}{-2}=\frac{x+2}{6}$$

$3y - 24 = -x - 2$

$x + 3y - 22 = 0$

2

$y-(-4)=\frac{1}{3}(x-9)$

$y+4=\frac{1}{3}(x-9)$

$3y+12=x-9$

$x-3y-21=0$

$a = 1, b = -3, c = -21$

3 Using points A and B:

$$\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}$$

$$\frac{y-3}{5-3}=\frac{x-0}{k-0}$$

$$\frac{y-3}{2}=\frac{x}{k}$$

$ky - 3k = 2x$

Substituting point C into the equation:

$k(2k) - 3k = 2(10)$

$2k^2 - 3k - 20 = 0$

$(2k + 5)(k - 4) = 0$

$k = -\frac{5}{2}$ or $k = 4$

4 a The gradient of l_1 is 3.

So the gradient of l_2 is $-\frac{1}{3}$.

The equation of line l_2 is:

$y-2=-\frac{1}{3}(x-6)$

$y-2=-\frac{1}{3}x+2$

$y=-\frac{1}{3}x+4$

b $l_1: y=3x-6$

$l_2: y=-\frac{1}{3}x+4$

$3x+\frac{1}{3}x=4+6$

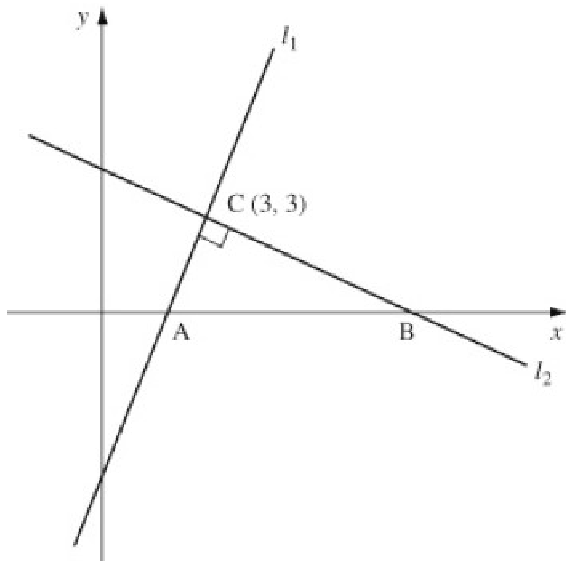
$\frac{10}{3}x=10$

$x = 3$

$y = 3 \times 3 - 6 = 3$

The point C is (3, 3).

4 c



Where l_1 meets the x-axis, $y = 0$:

$0 = 3x - 6$

$3x = 6$

$x = 2$

The point A is (2, 0).

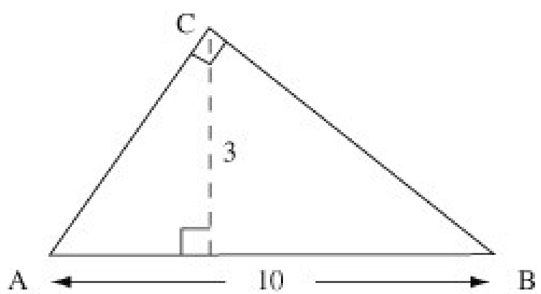
Where l_2 meets the x-axis, $y = 0$:

$0 = -\frac{1}{3}x + 4$

$\frac{1}{3}x = 4$

$x = 12$

The point B is (12, 0).



$AB = 12 - 2 = 10$

The perpendicular height, using AB as the base is 3.

Area of triangle $ABC = \frac{1}{2} \times \text{base} \times \text{height}$

$= \frac{1}{2} \times 10 \times 3$

$= 15 \text{ units}^2$

5 Using the sine rule:

$$\frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\frac{b}{\sin 45°} = \frac{\sqrt{5}}{\sin 30°}$$

$$b = \frac{\sqrt{5}\sin 45°}{\sin 30°}$$

$$b = \frac{\sqrt{5} \times \frac{\sqrt{2}}{2}}{\frac{1}{2}}$$

$$b = \sqrt{10}$$

$AC = \sqrt{10}$ cm

6 a Using the cosine rule:

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$\cos 60° = \frac{(2x-3)^2 + 5^2 - (x+1)^2}{2(2x-3)(5)}$$

$$\frac{1}{2} = \frac{4x^2 - 12x + 9 + 25 - (x^2 + 2x + 1)}{10(2x-3)}$$

$$5(2x - 3) = 3x^2 - 14x + 33$$

$$3x^2 - 24x + 48 = 0$$

$$x^2 - 8x + 16 = 0$$

b $x^2 - 8x + 16 = 0$

$(x - 4)^2 = 0$

$x = 4$

c Area $= \frac{1}{2}ac\sin B$

$a = 2 \times 4 - 3 = 5$

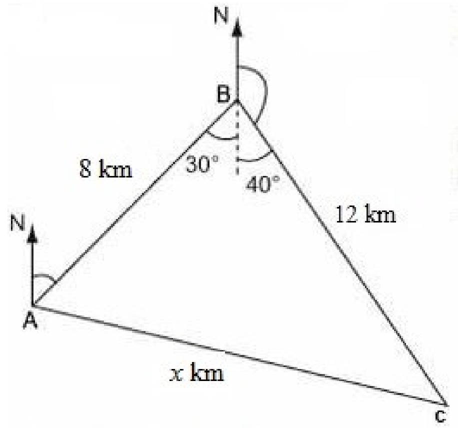
$c = 5$

Area $= \frac{1}{2} \times 5 \times 5 \times \sin 60°$

$= 10.8253...$

$= 10.8\text{ cm}^2$ (3 s.f.)

7



a Using the cosine rule

$x^2 = 8^2 + 12^2 - 2 \times 8 \times 12 \times \cos 70°$

$= 142.332\ldots$

$x = 11.93$ km

The distance of ship C from ship A is 11.93 km.

b Using the sine rule:

$$\frac{\sin 70°}{11.93} = \frac{\sin A}{12}$$

$\sin A = 0.94520\ldots$

$A = 70.9°$

The bearing of ship C from ship A is 100.9°.

8 a If triangle ABC is isosceles, then two of the sides are equal.

$AB = \sqrt{(6+2)^2 + (10-4)^2} = \sqrt{100} = 10$

$BC = \sqrt{(16-6)^2 + (10-10)^2} = \sqrt{100} = 10$

$AC = \sqrt{(16+2)^2 + (10-4)^2} = \sqrt{360} = 6\sqrt{10}$

$AB = BC$, therefore ABC is isosceles.

b Using the cosine rule:

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

$$= \frac{10^2 + 10^2 - \left(\sqrt{360}\right)^2}{2(10)(10)}$$

$$= \frac{100 + 100 - 360}{200}$$

$$= -\frac{4}{5}$$

$B = 143.13010...$

$\angle ABC = 143.1°$ (1 d.p.)

9 Using the sine rule in triangle ABD:

$$\frac{\sin \angle BDA}{4.3} = \frac{\sin 40°}{3.5}$$

$$\sin \angle BDA = \frac{4.3 \sin 40°}{3.5} = 0.78971\ldots$$

$$\angle BDA = 52.16°$$

Using the angle sum of a triangle:

$$\angle ABD = 180° - (52.16° + 40°) = 87.84°$$

Using the sine rule in triangle ABD:

$$\frac{AD}{\sin 87.84} = \frac{3.5}{\sin 40°}$$

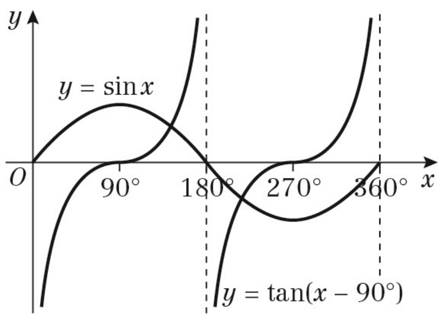
$$AD = 5.44\text{ cm}$$

$$AC = AD + DC = 5.44 + 8.6 = 14.04\text{ cm}$$

Area of triangle ABC

$$= \tfrac{1}{2} \times 4.3 \times 14.04 \times \sin 40° = 19.4\text{ cm}^2$$

10 a



b There are two solutions in the interval $0 \le x \le 360°$.

11 a The curve $y = \sin x$ crosses the x-axis at $(-360°, 0)$, $(-180°, 0)$, $(0°, 0)$, $(180°, 0)$ and $(360°, 0)$.

$y = \sin(x + 45°)$ is a translation of $\begin{pmatrix} -45° \\ 0 \end{pmatrix}$ so subtract 45° from the x-coordinates.

The curve crosses the x-axis at $(-405°, 0)$, $(-225°, 0)$, $(-45°, 0)$, $(135°, 0)$ and $(315°, 0)$.

$(-405°, 0)$ is not in the range, so $(-225°, 0)$, $(-45°, 0)$, $(135°, 0)$ and $(315°, 0)$

b The curve $y = \sin(x + 45°)$ crosses the y-axis when $x = 0$.

$$\sin 45° = \frac{\sqrt{2}}{2}$$

$$\left(0, \frac{\sqrt{2}}{2}\right)$$

12 Crosses y-axis when $x = 0$ at $\sin \frac{3\pi}{4} = \frac{1}{\sqrt{2}}$

Crosses x-axis when $\sin\left(x + \frac{3\pi}{4}\right) = 0$

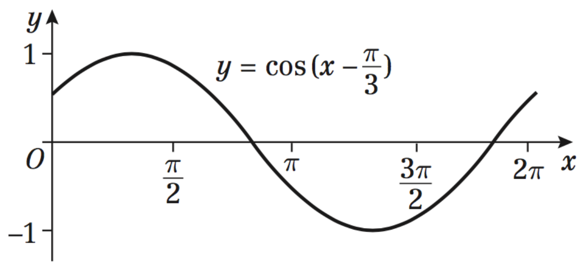
$$x + \frac{3\pi}{4} = -\pi, 0, \pi, 2\pi$$

$$x = -\frac{7\pi}{4}, -\frac{3\pi}{4}, \frac{\pi}{4}, \frac{5\pi}{4}$$

So coordinates are

$$\left(0, \frac{1}{\sqrt{2}}\right), \left(-\frac{7\pi}{4}, 0\right), \left(-\frac{3\pi}{4}, 0\right), \left(\frac{\pi}{4}, 0\right), \left(\frac{5\pi}{4}, 0\right)$$

13 a $y = \cos\left(x - \frac{\pi}{3}\right)$ is $y = \cos x$ translated by the vector $\begin{pmatrix} \frac{\pi}{3} \\ 0 \end{pmatrix}$



13 b Crosses y-axis when $y = \cos\left(-\frac{\pi}{3}\right) = \frac{1}{2}$

Crosses x-axis when $\cos\left(x - \frac{\pi}{3}\right) = 0$

$x - \frac{\pi}{3} = \frac{\pi}{2}, \frac{3\pi}{2}$

$x = \frac{5\pi}{6}, \frac{11\pi}{6}$

So coordinates are

$\left(0, \frac{1}{2}\right), \left(\frac{5\pi}{6}, 0\right), \left(\frac{11\pi}{6}, 0\right)$

c $\cos\left(x - \frac{\pi}{3}\right) = -0.27,\ 0 \le x \le 2\pi$

$\cos^{-1}(-0.27) = 1.844$ (3 d.p.)

$x - \frac{\pi}{3} \approx 1.844$ and $x - \frac{\pi}{3} \approx 2\pi - 1.844$

$x = 2.89, 5.49$ (2 d.p.)

14 a Let C be the midpoint of AB.
Then $AC = 3$ cm, and AOC is a right-angled triangle.

$\sin\left(\frac{\theta}{2}\right) = \frac{3}{5} = 0.6$

$\frac{\theta}{2} = \sin^{-1}(0.6)$

$\theta = 2 \times \sin^{-1}(0.6) = 1.29$ rad (3 s.f.)

b Use $l = r\theta$
Minor arc $AB = 5 \times 1.29 = 6.45\,\text{cm}$ (3 s.f.)

15 As ABC is equilateral, $BC = AC = 8\,\text{cm}$
$BP = AB - AP = 8 - 6 = 2\,\text{cm}$
$QC = BP = 2\,\text{cm}$

$\angle BAC = \frac{\pi}{3},\ PQ = 6 \times \frac{\pi}{3} = 2\pi$

$= 6.28\,\text{cm}$ (2 d.p.)

So perimeter $= BC + BP + PQ + QC$
$= 18.28\,\text{cm}$ (2 d.p.)

Exact answer $12 + 2\pi\,\text{cm}$

16 a $\frac{1}{2}(r + 10)^2\theta - \frac{1}{2}r^2\theta = 40$

$20r\theta + 100\theta = 80$

$r\theta + 5\theta = 4$

$\Rightarrow r = \frac{4}{\theta} - 5$

b $r = \frac{4}{\theta} - 5 = 6\theta$

$4 - 5\theta = 6\theta^2$

$6\theta^2 + 5\theta - 4 = 0$

$(3\theta + 4)(2\theta - 1) = 0$

$\Rightarrow \theta = -\frac{4}{3}$ or $\frac{1}{2}$

But θ cannot be negative, so $\theta = \frac{1}{2}, r = 3$

So perimeter $= 20 + r\theta + (10 + r)\theta$

$= 20 + \frac{3}{2} + \frac{13}{2} = 28\,\text{cm}$

17 a arc $BD = 10 \times 0.6 = 6\,\text{cm}$

b Area of triangle $ABC = \frac{1}{2}(13 \times 10)\sin 0.6$

$= 65 \times 0.567$

$= 36.7\,\text{cm}^2$ (1 d.p.)

Area of sector $ABD = \frac{1}{2}10^2 \times 0.6$

$= 30\,\text{cm}^2$

Area of shaded area $BCD = 36.7 - 30$

$= 6.7\,\text{cm}^2$ (1 d.p.)

18 a $\angle OED = 90^\circ$ because BC is parallel to ED

So $r = \frac{10}{\cos 0.7} = 13.07\,\text{cm}$ (2 d.p.)

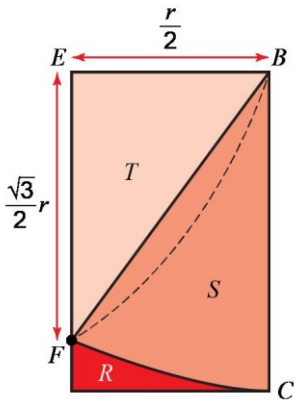
Area of sector $OAB = \frac{1}{2}r^2 \times 1.4$

$= 119.7\,\text{cm}^2$ (1 d.p.)

b $BC = AC = r\tan 0.7$

So perimeter $= 2r\tan 0.7 + r \times 1.4$
$= (2 \times 13.07 \times 0.842) + (13.07 \times 1.4)$
$= 40.3$ cm

19 Split each half of the rectangle as shown.



EFB is a right-angled triangle, and by Pythagoras' theorem, $EF = \frac{\sqrt{3}}{2}r$.

Let $\angle EBF = \theta$, so $\tan\theta = \sqrt{3}$, so $\theta = \frac{\pi}{3}$

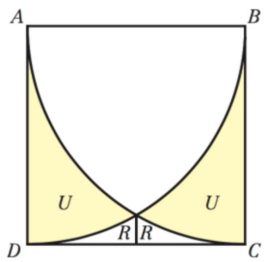
So $\angle FBC = \frac{\pi}{2} - \frac{\pi}{3} = \frac{\pi}{6}$

$$\text{Area } S = \frac{1}{2}r^2\frac{\pi}{6} = \frac{\pi}{12}r^2$$

$$\text{Area } T = \frac{1}{2}\times\frac{\sqrt{3}}{2}r\times\frac{1}{2}r = \frac{\sqrt{3}}{8}r^2$$

$$\Rightarrow \text{Area } R = \frac{1}{2}r^2 - \text{Area } S - \text{Area } T$$

$$= \left(\frac{1}{2} - \frac{\sqrt{3}}{8} - \frac{\pi}{12}\right)r^2$$



$$\text{Area of sector } ACB = \frac{1}{2}r^2\frac{\pi}{2} = \frac{\pi}{4}r^2$$

$$\text{Area } U = \text{Area } ABCD - \text{Area sector } ACB - 2R$$

$$= r^2 - \frac{\pi}{4}r^2 - 2\left(\frac{1}{2} - \frac{\sqrt{3}}{8} - \frac{\pi}{12}\right)r^2$$

$$= r^2\left(\frac{\sqrt{3}}{4} - \frac{\pi}{12}\right)$$

So area $U = r^2 - \frac{\pi}{4}r^2 - 2R$

$$= \left(1 - \frac{\pi}{4} - 1 + \frac{\sqrt{3}}{4} + \frac{\pi}{6}\right)r^2$$

$$= r^2\left(\frac{\sqrt{3}}{4} - \frac{\pi}{12}\right) = \frac{r^2}{12}\left(3\sqrt{3} - \pi\right)$$

So shaded area $= 2U = \frac{r^2}{6}\left(3\sqrt{3} - \pi\right)$

Thus $U = \frac{r^2}{12}\left(3\sqrt{3} - \pi\right)$

20 $f(x) = 5x^2$

$$f'(x) = \lim_{h\to 0}\frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h\to 0}\frac{5(x+h)^2 - 5x^2}{h}$$

$$= \lim_{h\to 0}\frac{5x^2 + 10xh + 5h^2 - 5x^2}{h}$$

$$= \lim_{h\to 0}\frac{10xh + 5h^2}{h}$$

$$= \lim_{h\to 0}\frac{h(10x + 5h)}{h}$$

$$= \lim_{h\to 0}(10x + 5h)$$

As $h \to 0$, $10x + 5h \to 10x$, so $f'(x) = 10x$

21 $y = 4x^3 - 1 + 2x^{\frac{1}{2}}$

$$\frac{dy}{dx} = \left(4\times 3x^2\right) + \left(2\times\frac{1}{2}x^{-\frac{1}{2}}\right)$$

$$\frac{dy}{dx} = 12x^2 + x^{-\frac{1}{2}}$$

Or:

$$\frac{dy}{dx} = 12x^2 + \frac{1}{x^{\frac{1}{2}}}$$

Or:

$$\frac{dy}{dx} = 12x^2 + \frac{1}{\sqrt{x}}$$

22 a $y = 4x + 3x^{\frac{3}{2}} - 2x^2$

$\frac{dy}{dx} = (4 \times 1x^0) + \left(3 \times \frac{3}{2}x^{\frac{1}{2}}\right) - (2 \times 2x^1)$

$\frac{dy}{dx} = 4 + \frac{9}{2}x^{\frac{1}{2}} - 4x$

b For $x = 4$,

$y = (4 \times 4) + \left(3 \times 4^{\frac{3}{2}}\right) - (2 \times 4^2)$

$= 16 + (3 \times 8) - 32$

$= 16 + 24 - 32$

$= 8$

So P (4, 8) lies on C.

c For $x = 4$,

$\frac{dy}{dx} = 4 + \left(\frac{9}{2} \times 4^{\frac{1}{2}}\right) - (4 \times 4)$

$= 4 + \left(\frac{9}{2} \times 2\right) - 16$

$= 4 + 9 - 16$

$= -3$

This is the gradient of the tangent. The normal is perpendicular to the tangent, so the gradient is $-\frac{1}{m}$.

The gradient of the normal at P is $\frac{1}{3}$.

Equation of the normal:

$y - 8 = \frac{1}{3}(x - 4)$

$3y - 24 = x - 4$

$3y = x + 20$

d $y = 0$:

$0 = x + 20$

$x = -20$

Q is the point (−20, 0).

$PQ = \sqrt{(4 - (-20))^2 + (8 - 0)^2}$

$= \sqrt{24^2 + 8^2}$

$= \sqrt{576 + 64}$

$= \sqrt{640}$

$= \sqrt{64} \times \sqrt{10}$

$= 8\sqrt{10}$

23 a $y = 4x^2 + \frac{5 - x}{x}$

$= 4x^2 + 5x^{-1} - 1$

$\frac{dy}{dx} = (4 \times 2x^1) + (5 \times -1x^{-2})$

$= 8x - 5x^{-2}$

At P, $x = 1$, so

$\frac{dy}{dx} = (8 \times 1) - (5 \times 1^{-2})$

$= 8 - 5$

$= 3$

b At $x = 1$, $\frac{dy}{dx} = 3$

The value of $\frac{dy}{dx}$ is the gradient of the tangent.

At $x = 1$, $y = (4 \times 1^2) + \frac{5 - 1}{1}$

$= 4 + 4 = 8$

Equation of the tangent:

$y - 8 = 3(x - 1)$

$y = 3x + 5$

c $y = 0 : 0 = 3x + 5$

$3 = -5$

$x = -\frac{5}{3}$

So $k = -\frac{5}{3}$

24 a $f(x) = \frac{(2x + 1)(x + 4)}{\sqrt{x}}$

$= \frac{2x^2 + 9x + 4}{\sqrt{x}}$

$= 2x^{\frac{3}{2}} + 9x^{\frac{1}{2}} + 4x^{-\frac{1}{2}}$

$P = 2$, $Q = 9$, $R = 4$

b $f'(x) = \left(2 \times \frac{3}{2}x^{\frac{1}{2}}\right) + \left(9 \times \frac{1}{2}x^{-\frac{1}{2}}\right) + \left(4 \times -\frac{1}{2}x^{-\frac{3}{2}}\right)$

$= 3x^{\frac{1}{2}} + \frac{9}{2}x^{-\frac{1}{2}} - 2x^{-\frac{3}{2}}$

24 c At $x=1$,

$$f'(1)=\left(3\times 1^{\frac{1}{2}}\right)+\left(\tfrac{9}{2}\times 1^{-\frac{1}{2}}\right)-\left(2\times 1^{-\frac{3}{2}}\right)$$
$$=3+\tfrac{9}{2}-2$$
$$=\tfrac{11}{2}$$

The line $2y = 11x + 3$ is
$$y=\tfrac{11}{2}x+\tfrac{3}{2}$$
$\therefore$ The gradient is $\frac{11}{2}$.

The tangent to the curve where $x = 1$ is parallel to this line, since the gradients are equal.

25 a $y=3x^2+4\sqrt{x}$

$$=3x^2+4x^{\frac{1}{2}}$$
$$\frac{dy}{dx}=\left(3\times 2x^1\right)+\left(4\times\frac{1}{2}x^{-\frac{1}{2}}\right)$$
$$\frac{dy}{dx}=6x+2x^{-\frac{1}{2}}$$
Or :
$$\frac{dy}{dx}=6x+\frac{2}{x^{\frac{1}{2}}}=6x+\frac{2}{\sqrt{x}}$$

b
$$\frac{dy}{dx}=6x+2x^{\frac{-1}{2}}$$
$$\frac{d^2y}{dx^2}=6+\left(2\times -\frac{1}{2}x^{-\frac{3}{2}}\right)$$
$$=6-x^{\frac{-3}{2}}$$
Or:
$$\frac{d^2y}{dx^2}=6-\frac{1}{x^{\frac{3}{2}}}$$
Or :
$$\frac{d^2y}{dx^2}=6-\frac{1}{x\sqrt{x}}$$

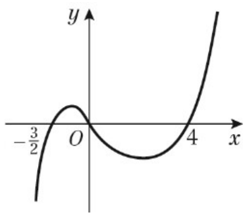
25 c
$$\int\left(3x^2+4x^{\frac{1}{2}}\right)dx=\frac{3x^3}{3}+\frac{4x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)}+C$$
$$=x^3+4\left(\tfrac{2}{3}\right)x^{\frac{3}{2}}+C$$
$$=x^3+\tfrac{8}{3}x^{\frac{3}{2}}+C$$
$$\left(\text{Or}: x^3+\tfrac{8}{3}x\sqrt{x}+C\right)$$

26 a $f'(x)=6x^2-10x-12$

$$f(x)=\frac{6x^3}{3}-\frac{10x^2}{2}-12x+C$$
When $x = 5$, $y = 65$, so:
$$65=\frac{6\times 125}{3}-\frac{10\times 25}{2}-60+C$$
$$65=250-125-60+C$$
$$C=65+125+60-250$$
$$C=0$$
$$f(x)=2x^3-5x^2-12x$$

b
$$f(x)=x\left(2x^2-5x-12\right)$$
$$f(x)=x(2x+3)(x-4)$$

c Curve meets x-axis where $y=0$
$$x(2x+3)(x-4)=0$$
$$x=0, x=-\tfrac{3}{2}, x=4$$
When $x\to\infty$, $y\to\infty$
When $x\to-\infty$, $y\to-\infty$



Crosses x-axis at $\left(-\tfrac{3}{2},0\right)$, $(0,0)$ and $(4,0)$.

Challenge

1 a Finding points B and C using $y = 3x - 12$:
When $y = 0$, $x = 4$
When $x = 0$, $y = -12$
The point B is (4, 0) and
the point C is (0, −12).
Using Pythagoras' theorem to find the length of the square:

$$BC = \sqrt{(0-4)^2 + (-12-0)^2} = \sqrt{160}$$

$$\text{Area of square} = \left(\sqrt{160}\right)^2 = 160$$

b The point A is (−8, 4) and
the point D is (−12, −8).

$$\text{The gradient of line } AD = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-8-4}{-12+8} = \frac{-12}{-4} = 3$$

The equation of line AD is:
$y - y_1 = m(x - x_1)$
$y - 4 = 3(x + 8)$
$y = 3x + 28$
When $y = 0$, $x = -\frac{28}{3}$
The point S is $(-\frac{28}{3}, 0)$.

2 Angle of minor arc $= \frac{\pi}{2}$ because it is a quarter circle
Let the chord meet the circle at R and T.
The area of P is the area of sector formed by O, R and T less the area of the triangle ORT.

$$\text{So area of } P = \frac{1}{2}r^2\frac{\pi}{2} - \frac{1}{2}r^2\sin\frac{\pi}{2}$$

$$= r^2\left(\frac{\pi}{4} - \frac{1}{2}\right) = \frac{r^2}{4}(\pi - 2)$$

$$\text{Area of } Q = \pi r^2 - \text{ area of } P$$

$$= r^2\left(\pi - \frac{\pi}{4} + \frac{1}{2}\right) = r^2\left(\frac{3\pi}{4} + \frac{1}{2}\right)$$

$$= \frac{r^2}{4}(3\pi + 2)$$

$$\text{So ratio} = (\pi - 2):(3\pi + 2) = \frac{\pi - 2}{3\pi + 2}:1$$

3 a $f'(-3) = k((-3)^2 - 3 - 6) = 0$
$f'(2) = k(2^2 + 2 - 6) = 0$
Using the factor theorem, $x + 3$ and $x - 2$ are factors of $f'(x)$.
So $f'(x) = k(x + 3)(x - 2)$
$= k(x^2 + x - 6)$
As $f(x)$ is cubic, there are no other factors of $f'(x)$.

b

$$\int k(x^2 + x - 6)\,dx = \int (kx^2 + kx - 6k)\,dx$$

$$= \frac{kx^3}{3} + \frac{kx^2}{2} - 6kx + c$$

At (−3, 76):

$$\frac{k(-3)^3}{3} + \frac{k(-3)^2}{2} - 6k(-3) + c = 76$$

$$-9k + \frac{9k}{2} + 18k + c = 76$$

$$\frac{27k}{2} + c = 76$$

At (2, −49):

$$\frac{k(2)^3}{3} + \frac{k(2)^2}{2} - 6k(2) + c = -49$$

b

$$\frac{8k}{3} + 2k - 12k + c = -49$$

$$-\frac{22k}{3} + c = -49$$

Solving $\frac{27k}{2} + c = 76$ and $-\frac{22k}{3} + c = -49$ simultaneously

$$c = 76 - \frac{27k}{2} \text{ and } c = \frac{22k}{3} - 49$$

$$\text{So } 76 - \frac{27k}{2} = \frac{22k}{3} - 49$$

$456 - 81k = 44k - 294$
$125k = 750$
$k = 6$, $c = -5$

$$f(x) = \frac{kx^3}{3} + \frac{kx^2}{2} - 6kx + c$$

$$= \frac{6x^3}{3} + \frac{6x^2}{2} - 6(6)x - 5$$

$$= 2x^3 + 3x^2 - 36x - 5$$