Revision exercise A1

1 **a)** Draw the graphs of $y = x^2 - 2x + 3$ and $y = 4x + 1$ on the same grid.
Use values of x from 0 to 6.
b) Use the graphs to solve, simultaneously, the equations $y = x^2 - 2x + 3$ and $y = 4x + 1$.
Give the answers correct to 1 decimal place.

2 **a)** Draw the graphs of $x^2 + y^2 = 9$ and $y = x + 2$ on the same grid.
Use a scale of 1 cm to 1 unit for both x and y.
b) Use the graph to solve the simultaneous equations $x^2 + y^2 = 9$ and $y = x + 2$.
Give the answers correct to 1 decimal place.

3 Solve these simultaneous equations graphically.
$x^2 + y^2 = 36$ and $y = x + 6$

4 **a)** Draw the graph of $y = x^2 + 3x - 7$ for x from $^-6$ to 3.
b) Use the graph to solve these equations.
(i) $x^2 + 3x - 7 = 0$
(ii) $x^2 + 3x - 10 = 0$
c) **(i)** Find the line that must be drawn to solve $x^2 + x - 4 = 0$.
(ii) Draw the line and use it to solve $x^2 + x - 4 = 0$.

5 In a chemical reaction, the mass of a chemical present is decreasing by 5% per minute.
Initially there is 20 g of the chemical.
Find, in minutes correct to 1 decimal place, the time that passes before there is 2 g of this chemical left.

6 Copy and complete the table of values for $y = 2^{-x}$.

x	0	0·5	1	1·5	2	2·5	3	3·5	4
y	1								

Plot the graph of $y = 2^{-x}$ for these values.
Use a scale of 2 cm to 1 unit on the x-axis and 1 cm to 0·1 unit on the y-axis.
Use your graph to estimate
a) the value of y when $x = 1{\cdot}8$.
b) the solution to the equation $2^{-x} = 0{\cdot}6$.

7 The size, y, of a population of flies after t days was given by $y = 100 \times 1{\cdot}2^t$.
a) What was the size of the population at $t = 0$?
b) What was the size of the population after 5 days?
c) Use trial and improvement to find the number of days it took for the population to reach 1000, assuming this rate of growth continued. Give your answer to 1 decimal place.

8 The curve $y = ab^x$ passes through (0, 10) and (2, 6·4).
Find the values of a and b.

9 State which of these numbers are rational and which are irrational, showing how you decide.
a) $^-1{\cdot}6$ **b)** $0{\cdot}\dot{7}\dot{3}$
c) $\frac{5\pi}{3}$ **d)** $7 + 2\sqrt{3}$
e) 1·414

10 Convert these fractions to recurring decimals, using the dot notation.
a) $\frac{5}{11}$ **b)** $\frac{212}{999}$
c) $\frac{37}{495}$

11 Convert these recurring decimals to fractions or mixed numbers in their lowest terms.

a) $0\dot{5}\dot{4}$ **b)** $3\cdot1\dot{4}\dot{7}$

c) $0\cdot\dot{2}03\dot{4}$

Do not use a calculator for questions **12** to **16**.

12 Simplify these.

a) $\sqrt{32}$

b) $\sqrt{150}$

c) $\sqrt{128}$

d) $\sqrt{12} \times \sqrt{75}$

e) $\sqrt{10} \times \sqrt{18}$

f) $\sqrt{72} \div 3$

g) $\sqrt{288} \times \sqrt{48}$

13 If $x = 3 + \sqrt{7}$ and $y = 5 - 4\sqrt{7}$, simplify these.

a) $x + y$ **b)** $x - y$

c) xy

14 If $x = 5 + 2\sqrt{3}$ and $y = 5 - 2\sqrt{3}$, simplify these.

a) x^2 **b)** y^2

c) xy

15 Simplify $\sqrt{10}(5 + 2\sqrt{10})^2$.

16 Rationalise the denominator in the following, simplifying where possible.

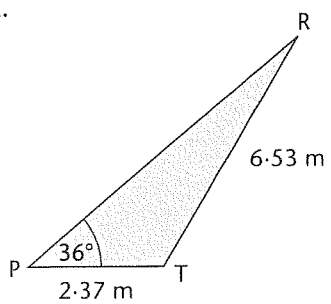
a) $\frac{11}{\sqrt{2}}$ **b)** $\frac{15}{\sqrt{12}}$ **c)** $\frac{6}{\sqrt{27}}$

17 In triangle PRT, find

a) angle PRT.

b) angle PTR.

c) PR.

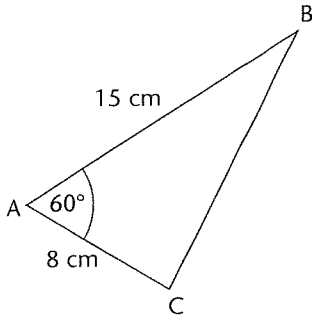


18 In triangle ABC, find

a) BC.

b) angle ABC.

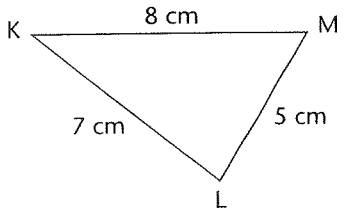
c) the area of triangle ABC.



19 In triangle KLM, find

a) angle LKM.

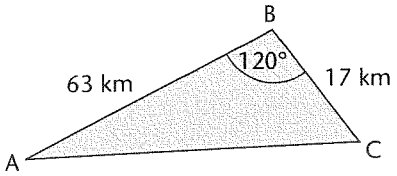
b) angle KML.



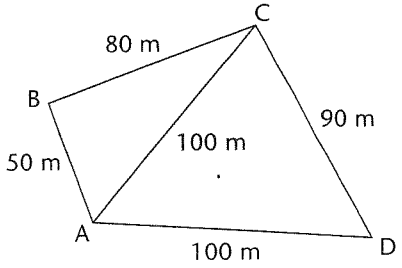
20 In triangle ABC, find

a) AC.

b) angle BAC.



21 ABCD is a field with dimensions as shown in the diagram. Calculate the area of the field.



Revision exercise B1

1 The figures in the table show Colin's electricity bills (in £).

	1st quarter	2nd quarter	3rd quarter	4th quarter
2003	120·34	78·61	56·98	110·55
2004	126·92	75·03	55·09	120·81
2005	132·67	81·32	61·14	123·50
2006	143·84	79·89	70·83	125·16

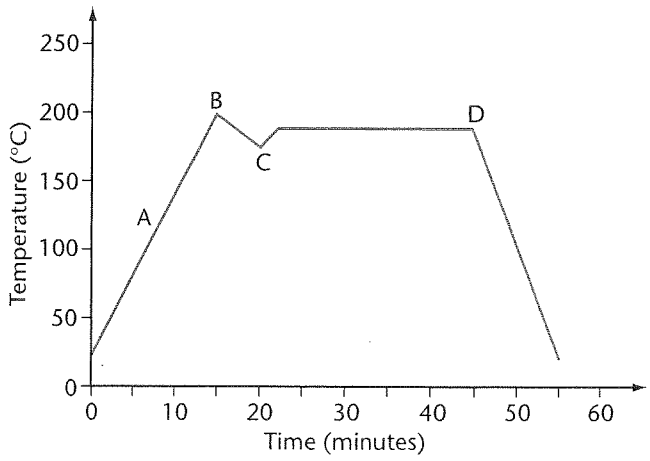
a) Plot these figures on a graph.
b) Calculate the four-point moving averages and plot them on your graph.
c) What do you notice?
d) Predict the bills for the next four quarters.

2 The table gives the rainfall in millimetres for each month in Huangogo in Central Africa during a three-year period.

	J	F	M	A	M	J	J	A	S	O	N	D
2004	25	40	67	104	15	2	0	0	0	4	29	21
2005	30	38	80	116	10	0	0	0	6	7	36	19
2006	28	46	91	115	18	6	0	0	4	11	40	23

a) In Central Africa there is a rainy season and a dry season. Identify when these are.
b) Calculate a suitable moving average and comment on any trend.

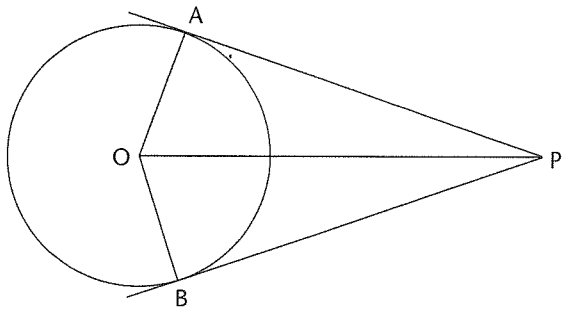
3 The graph shows the temperature of a commercial oven used for baking large quantities of pastry at one time.



a) Describe what is happening at points A, B, C, and D.
b) Find the rate of warming up at A.

4 Join the midpoints of the sides of a square to form a quadrilateral.
Prove that this quadrilateral is a square.

5 PA and PB are tangents to the circle with centre O.
Prove that triangles AOP and BOP are congruent.



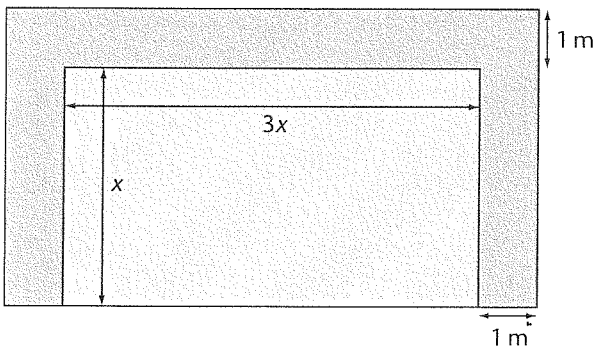
6 In the diagram for question **5**, let D be the point where AB crosses OP.
Prove that triangles PAD and PBD are congruent.

7 Solve these quadratic equations by completing the square.
Give your answers correct to 2 decimal places.

a) $x^2 - 6x + 2 = 0$
b) $4x^2 - 5x - 3 = 0$
c) $3x^2 + 4x - 2 = 0$
d) $x^2 + 13x - 27 = 0$
e) $2x^2 + 10x - 19 = 0$

8 Write $y = x^2 - 5x + 4$ in the form $y = (x - a)^2 + b$.
Hence state the coordinates of the lowest point on the graph of $y = x^2 - 5x + 4$.

9 A rectangular lawn is three times as wide as it is long.
It has a path 1 m wide round three sides as shown in the diagram.



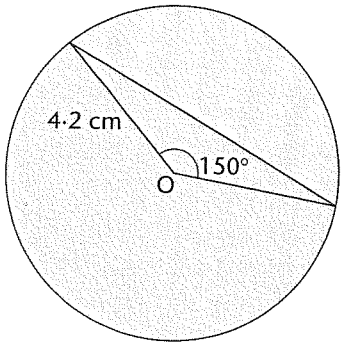
The area of the path, shaded brown, is equal to the area of the lawn.

a) Explain why $3x^2 = 5x + 2$.
b) Solve the equation $3x^2 - 5x - 2 = 0$ to find the dimensions of the lawn.

10 Use the quadratic formula to solve these equations.
Give your answers correct to 3 decimal places.

a) $5x^2 - 8x + 1 = 0$
b) $x^2 - 7x - 2 = 0$
c) $6x^2 + 2x - 7 = 0$
d) $3x^2 + 5x - 10 = 0$
e) $5x^2 + 3x - 4 = 0$

11 O is the centre of the circle.
Calculate the area of the blue segment.

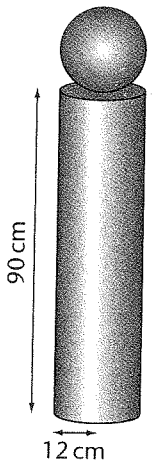


12 A solid cone and a solid cylinder both have base radius 6 cm.
The height of the cylinder is 4 cm.
The cone and the cylinder both have the same volume.

a) Find the height of the cone.
b) Calculate the curved surface area of the cylinder.

13 A sphere has volume 50 cm^3.
Calculate its surface area.

14 A traffic bollard consists of a sphere on top of a cylinder.
The radii of the sphere and cylinder are each 12 cm.
The height of the cylinder is 90 cm.
One litre of black paint covers 4 m^2.
How many of these bollards can be painted with 10 litres of paint?



Revision exercise C1

1 Simplify these.

a) $\frac{x}{2} + \frac{x+2}{3}$

b) $\frac{2x-1}{4} - \frac{2x+3}{5}$

c) $\frac{1}{x+1} + \frac{2}{x-2}$

d) $\frac{2x}{x-1} - \frac{x-1}{x+2}$

e) $\frac{3x^2+9x}{x^2+4x+3}$

2 Solve these equations.

a) $x(x-2) - 2x(x-3) = 12 - x^2$

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

c) $x + 1 = \frac{16}{x+1}$

d) $\frac{x^2}{3} - \frac{x}{3} - 4 = 0$

e) $\frac{1}{x+1} = \frac{4}{3x+2}$

f) $x + 2 = \frac{15}{x}$

g) $\frac{5}{x+1} - \frac{2}{x-1} = \frac{1}{3}$

3 Given that $\mathbf{a} = \begin{pmatrix}1\\2\end{pmatrix}$, $\mathbf{b} = \begin{pmatrix}-2\\1\end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix}-1\\-3\end{pmatrix}$, work out these.

a) $2\mathbf{a}$

b) $\mathbf{a} - \mathbf{b}$

c) $\mathbf{a} - \mathbf{b} + \mathbf{c}$

d) $\mathbf{a} + 2\mathbf{b}$

e) $3\mathbf{a} + 2\mathbf{c}$

f) $\frac{1}{2}\mathbf{a}$

g) $2\mathbf{a} - 3\mathbf{c}$

h) $\frac{1}{2}\mathbf{b} - \frac{1}{2}\mathbf{c}$

i) $\mathbf{a} - \frac{1}{2}\mathbf{c} - \mathbf{b}$

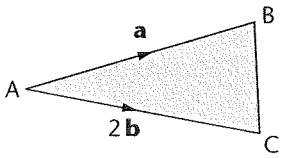
4 What are the coordinates of the image when

a) the point $(-2, 1)$ is translated by $\begin{pmatrix}1\\2\end{pmatrix}$?

b) the point $(4, 3)$ is translated by $\begin{pmatrix}-4\\-3\end{pmatrix}$?

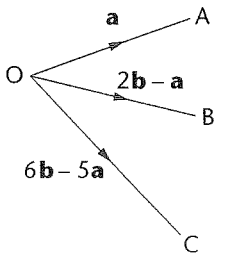
c) the point $(2, -4)$ is translated by $\begin{pmatrix}3\\-1\end{pmatrix}$?

5 In the triangle ABC, $\overrightarrow{AB} = \mathbf{a}$ and $\overrightarrow{AC} = 2\mathbf{b}$.



Write down the vector $\overrightarrow{BC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.

6 In the diagram, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = 2\mathbf{b} - \mathbf{a}$ and $\overrightarrow{OC} = 6\mathbf{b} - 5\mathbf{a}$.

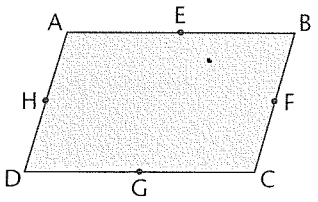


a) Work out the vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$ in terms of $\mathbf{a}$ and/or $\mathbf{b}$.

b) What can you say about AB and BC?

7 ABCD is a parallelogram.
E, F, G and H are the midpoints of the sides.

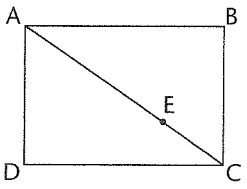
$\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{AD} = \mathbf{q}$.



a) Find the vectors $\overrightarrow{EB}$, $\overrightarrow{BF}$, $\overrightarrow{EF}$, $\overrightarrow{HD}$, $\overrightarrow{DG}$ and $\overrightarrow{HG}$ in terms of **p** and **q**.
b) What can you say about HG and EF?

8 ABCD is a rectangle.
E is a point on the diagonal AC so that AE $= 2 \times$ EC.

$\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{AD} = \mathbf{q}$.



Work out the vector $\overrightarrow{EB}$.

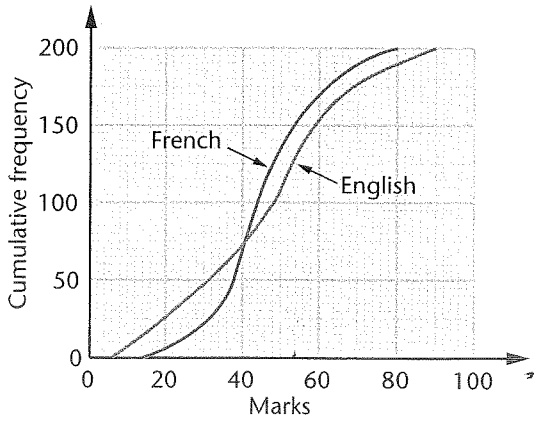
9 ABCD is a quadrilateral with $\overrightarrow{AB} = 3\mathbf{p}$, $\overrightarrow{AD} = \mathbf{q}$ and $\overrightarrow{BC} = \mathbf{q} + 2\mathbf{p}$.
Use vectors to identify the type of quadrilateral.

10 The table shows the prices of a sample of 100 houses in the north-west of England.

Price (£000)	Number of houses
$150 < x \leq 170$	4
$170 < x \leq 190$	15
$190 < x \leq 210$	27
$210 < x \leq 230$	41
$230 < x \leq 250$	10
$250 < x \leq 270$	3

Find the median and interquartile range for this sample.
A similar sample in the south-east gave a median of £280 000 and an interquartile range of £190 000.
Compare the two areas.

11 These cumulative frequency diagrams show the marks obtained in examinations in French and English by 200 students in Year 8.



a) Draw box plots for each of the languages.
b) Use the median and interquartile range for each subject to compare the results.

12 The heights of students in two classes are measured. The results are given in the tables below.

Class 11A	
Height (H cm)	Frequency
$130 \leqslant H < 140$	1
$140 \leqslant H < 150$	4
$150 \leqslant H < 160$	9
$160 \leqslant H < 170$	8
$170 \leqslant H < 180$	2
$180 \leqslant H < 190$	2

Class 11B	
Height (H cm)	Frequency
$120 \leqslant H < 130$	4
$130 \leqslant H < 140$	5
$140 \leqslant H < 150$	8
$150 \leqslant H < 160$	3
$160 \leqslant H < 170$	3
$170 \leqslant H < 180$	1

a) Show the data on two histograms.
b) Compare the heights of the students in the two classes.

13 Solve these simultaneous equations.

a) $y = x^2 - 2x + 3$
$y = 2x$

b) $y = 2x^2 - 3x + 3$
$y = 3x - 1$

c) $y = x^2 - 4x + 5$
$y + 4x = 6$

d) $x^2 + y^2 = 36$
$y = x + 6$

14 Solve these simultaneous equations algebraically.

a) $y = x^2 - 3x$
$y = 8 - x$

b) $y = 2x^2 - 4x + 1$
$y = 3x - 2$

c) $y = x^2 - 5x + 5$
$x - 2y = 5$

d) $x^2 + y^2 = 29$
$x + 2y = 1$

15 Solve the simultaneous equations
$x^2 + y^2 = 9$
$y = x + 2$.
Give the answers correct to 1 decimal place.

Revision exercise D1

1 Sketch the graph of $y = \tan x$ for values of x from $^{-}90°$ to $450°$.

2 For what angles between $0°$ and $360°$ does $\tan x = 1$?

3 Sketch the graph of $y = \cos x$ for $0° \leqslant x \leqslant 360°$.
Given that one solution of $\cos x = {}^{-}0.8$ is $143°$ to the nearest degree, find the other solution between $0°$ and $360°$.

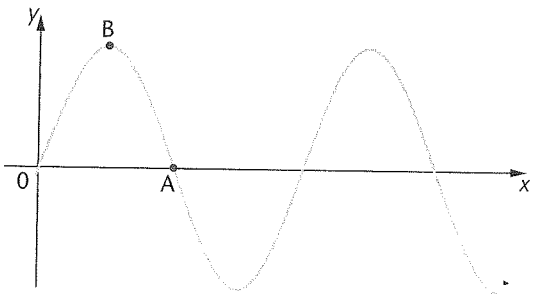
4 Given that one solution of $\sin x = {}^{-}\frac{1}{2}$ is $x = {}^{-}30°$, use the symmetry of the graph of $y = \sin x$ to find all the solutions between $0°$ and $360°$.

5 Using a calculator and sketch graph, or otherwise, solve the equation $\cos x = 0{\cdot}2$ for $0° \leqslant x \leqslant 360°$.

6 On the same set of axes, sketch the graphs of $y = \cos x$ and $y = \cos 2x$ for $0° \leqslant x \leqslant 360°$.

7 For $0° \leqslant x \leqslant 360°$, for what values of x does $\sin 2x = 1$?

8 This is the graph of $y = 2\sin 3x$.



State the coordinates of A and B.

9 Sketch the graph of $y = 3\cos 2x$ for $0° \leqslant x \leqslant 360°$.

10 $f(x) = x^2 - 2$. Find the equation of the graph of $y = x^2 - 2$ after it has been translated by $\begin{pmatrix}1\\0\end{pmatrix}$.

11 Describe the transformation which maps $y = g(x)$ on to each of these.
a) $y = g(3x)$
b) $y = 4g(x)$
c) $y = g(^{-}x)$

12 Sketch the graph of $y = \sin(4x)$ for values of x from $0°$ to $100°$.

13 **a)** Sketch the graph of $y = \sin(x + 90°)$.
b) State the equation of this graph more simply.

14 State the equation of the graph of $y = \cos x$ after
a) a translation of $\begin{pmatrix}0\\3\end{pmatrix}$.
b) a one-way stretch parallel to the x-axis with scale factor $0{\cdot}25$.

15 The graph of $y = x^2$ is translated by $\begin{pmatrix}3\\1\end{pmatrix}$ and then stretched with scale factor 2 parallel to the y-axis.
a) Find the equation of the resulting curve.
b) Find the coordinates of the minimum point on this curve.

16 A pack of cards contains five red, five blue, five green and five yellow cards. John takes two cards out without replacement.
What is the probability that
a) both cards are red?
b) the first card is red and the second card is blue?
c) at least one card is red?

17 On my way home from work I pass through three sets of traffic lights. The probabilities that I pass through them without stopping are $0{\cdot}2$, $0{\cdot}4$ and $0{\cdot}7$ respectively.
Find the probability that
a) I do not have to stop at any of the lights.
b) I have to stop at just one set of lights.
c) I have to stop at at least two sets of lights.