STUDENT MATERIALS

CONTENTS

TRIGONOMETRY

By the end of this set of exercises, you should be able to

(a) calculate the area of a triangle using trigonometry

(b) solve problems using Sine and Cosine rules.

TRIGONOMETRY

Introduction: Sine, Cosine and Tangent Graphs

Exercise 1A

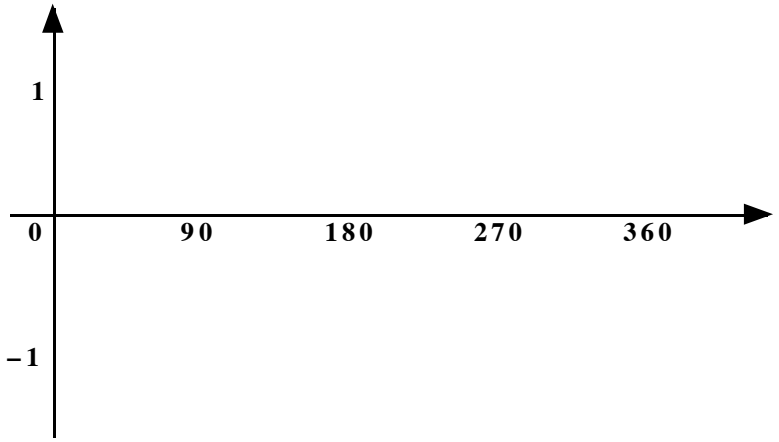
1. The Sine Graph

   (a) Make a copy of this table and use your calculator to help fill it in, giving each answer correct to 2 decimal places.

x	0°	20°	40°	60°	80°	90°	100°	120°	140°	160	180°
$\sin x°$	0·00	0·34	0·64	0·87	0·98	1·00	…	…	…	…	…

x	200°	220°	240°	260°	270°	280°	300°	320°	340°	360
$\sin x°$	…	…	…	…	…	…	…	…	…	…

   (b) Use a piece of 2 mm graph paper to draw a set of axes as illustrated below.



   (c) Plot as accurately as possible the 21 points from your table.

   (d) Join them up smoothly to create the graph of the function $y = \sin x°$.

2. Repeat question 1 (a) to (d) for the function $y = \cos x°$

3. Repeat for the graph of $y = \tan x°$ (a different scale will be required for the vertical axis). (These graphs will be studied later).

Sine, Cosine and Tangents of angles other than acute angles

Exercise 1B

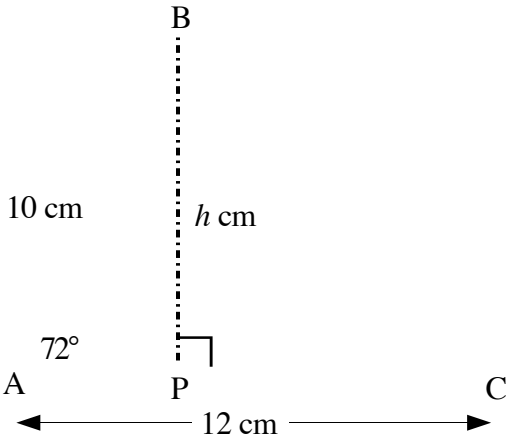
1. Use your calculator to find the following trigonometric ratios.
   Give each answer correct to 3 decimal places.

(a) sin 25°	(b) cos 95°	(c) tan 107°	(d) sin 200°
(e) cos 315°	(f) tan 181°	(g) cos 240°	(h) sin 330°
(i) tan 225°	(j) sin 300°	(k) tan 315°	(l) cos 500°
(m) tan (–75°)	(n) cos (–200°)	(o) sin 360°	(p) cos 360°

A. Area of a Triangle using Trigonometry.

Exercise 2

1. In this question you are being asked to calculate the area of triangle ABC, using two methods.



Method 1 (a) Use basic right angled trigonometry on triangle ABP to calculate the height BP (= h cm).

(b) Now use the formula Area = $^1/_2$ (base x height) to calculate the area of ΔABC.

Method 2 Use the formula:

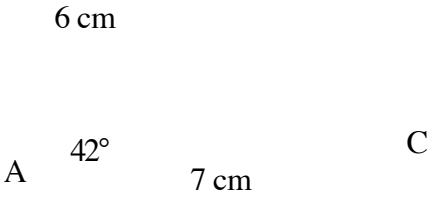
Area = $^1/_2\, b\, c \sin A$ with b = 12 cm, c = 10 cm and angle A = 72°

to calculate the area of triangle ABC.

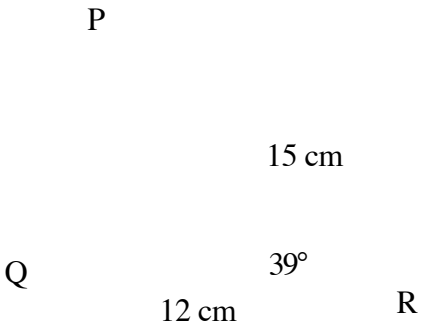
Did you obtain the same answer? Which method was the faster?

2. Use the formula Area = $^1/_2\, a\, b \sin C$ to calculate the areas of the following six triangles: (Give all answers correct to 1 decimal place).

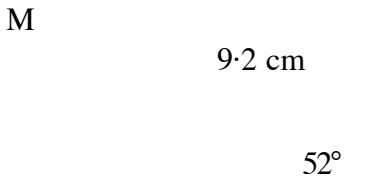
(a)



(b)

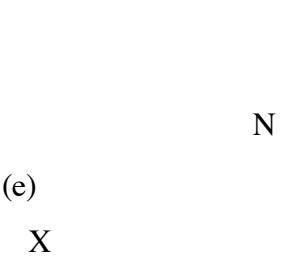


(c)

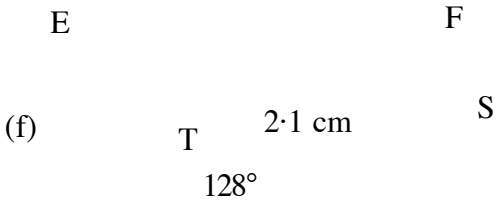


(d)

(e)

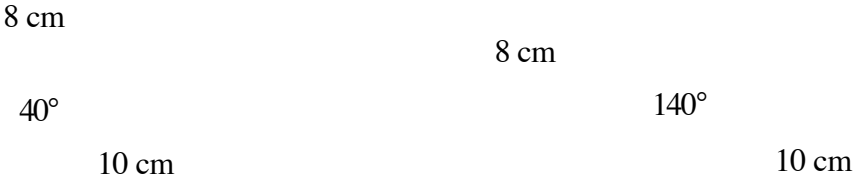


(f)



3. Calculate the areas of the following two triangles:

(a) (b)



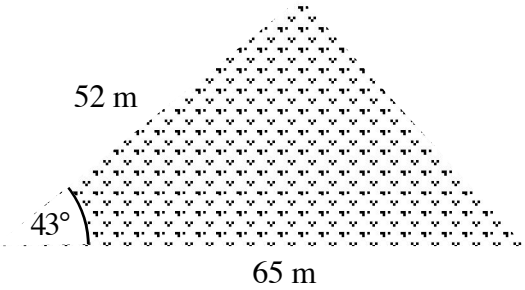
What do you notice?

4. Calculate the areas of the following two triangles:

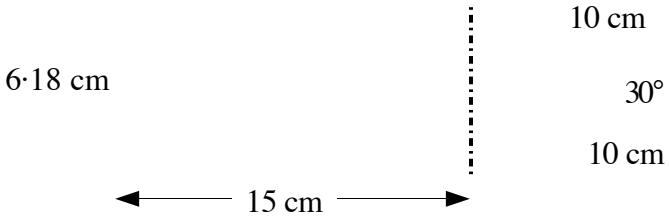
(a) (b)

What do you notice? Can you explain your answers to questions 3 and 4?

5. Shown is a sketch of Farmer Giles' triangular field.
Calculate its area in square metres.

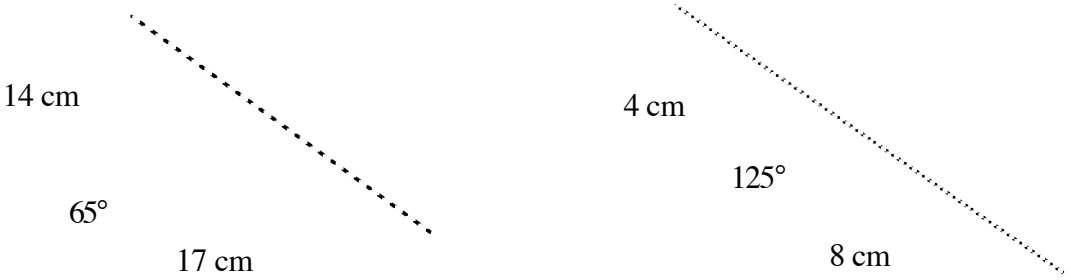


6. Calculate the area of this pentagon:



7. Calculate the areas of the following two parallelograms:

(a) (b)

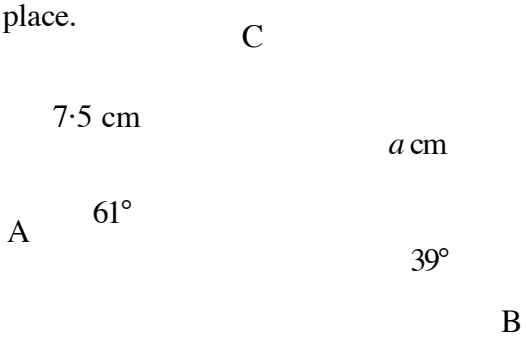


B . Sine Rule.

Exercise 3

In this exercise, give all answers correct to 1 decimal place.

1. Copy and complete the following:



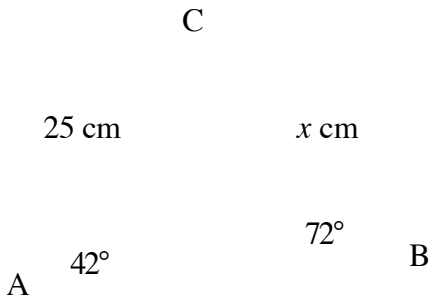
$$\frac{a}{\text{Sin A}} = \frac{b}{\text{Sin B}} = \left(\frac{c}{\text{Sin C}}\right)$$

$$\frac{a}{\text{Sin } 61°} = \frac{7{\cdot}5}{\text{Sin } 39°}$$

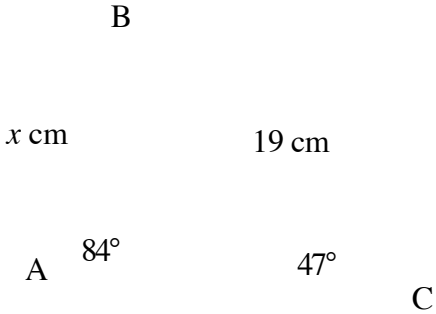
$$\Rightarrow \quad a = \frac{7{\cdot}5 \times \text{Sin } 61°}{\text{Sin } 39°} = \underline{\quad\quad} \text{ cm}$$

2. Use the Sine Rule in each of the following to calculate the size of the side marked x cm.

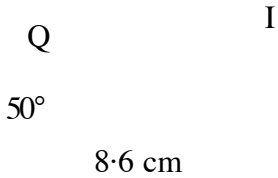
(a)



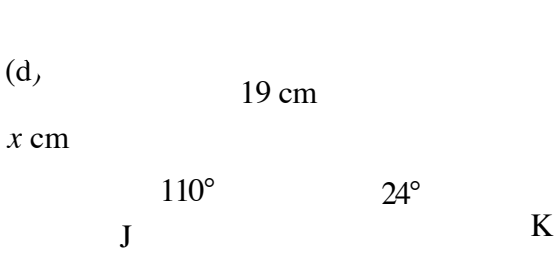
(b)



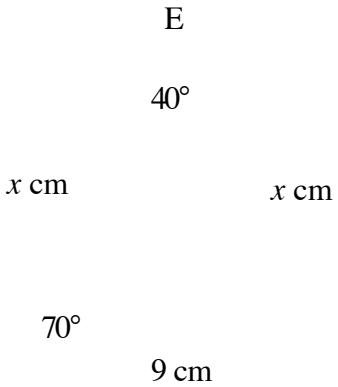
(c)



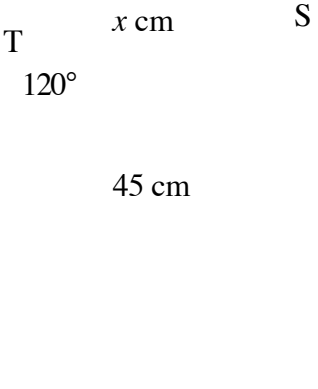
(d)



(e)

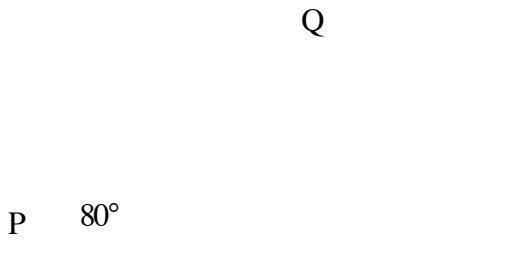


(f)



3. (a) Write down the size of ∠PQR.

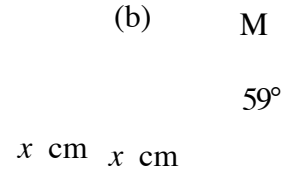
(b) Use the Sine rule to calculate the length of the line QR.



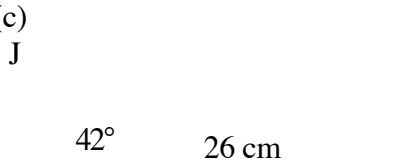
4. In each of the following, calculate the size of the third angle first before attempting to calculate the length of the side marked x cm.

(a)

(b)

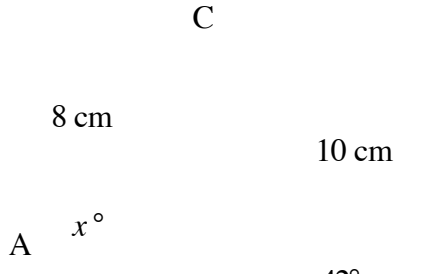


(c)



5. Copy and complete:

$$\frac{a}{\text{Sin A}} = \frac{b}{\text{Sin B}} = \left(\frac{c}{\text{Sin C}}\right)$$



$$\frac{10}{\text{Sin } x^\circ} = \frac{8}{\text{Sin } 42^\circ}$$

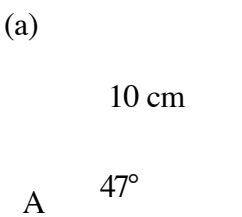
$$\Rightarrow 8 \text{ Sin } x^\circ = 10 \text{ Sin } 42^\circ$$

$$\Rightarrow \text{Sin } x = \frac{10 \text{ Sin } 42^\circ}{8} = 0\cdot \ldots\ldots$$

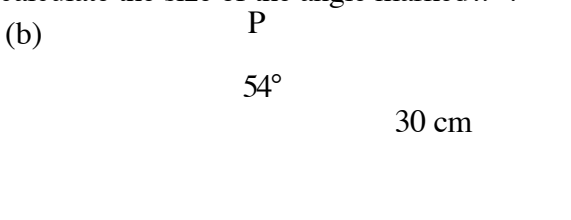
$$\Rightarrow x = \square$$

6. Use the Sine Rule in each of the following to calculate the size of the angle marked x °.

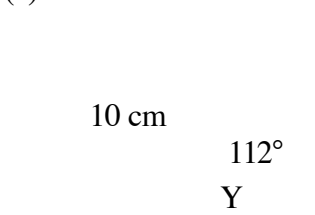
(a)



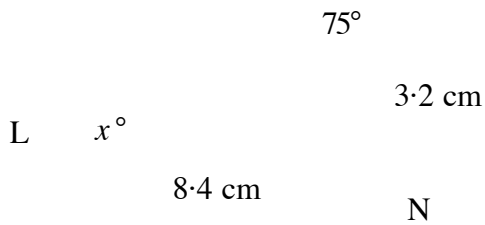
(b)



(c)

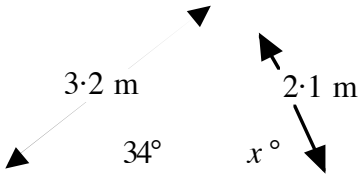


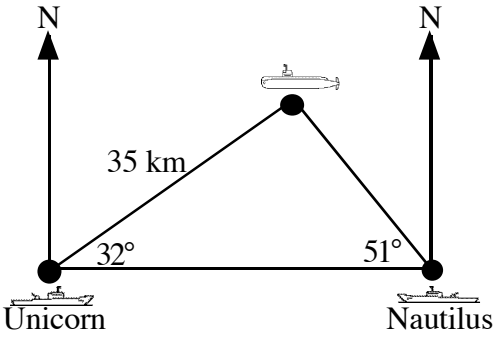
(d)



7. The diagram shows a roof truss.

Calculate the size of the angle marked $x°$ between the wooden supports.



8. 

H.M.S. Nautilus lies East of H.M.S. Unicorn.

The diagram shows where an enemy submarine is in relation to the two ships.

Calculate how far the submarine is from H.M.S. Nautilus.

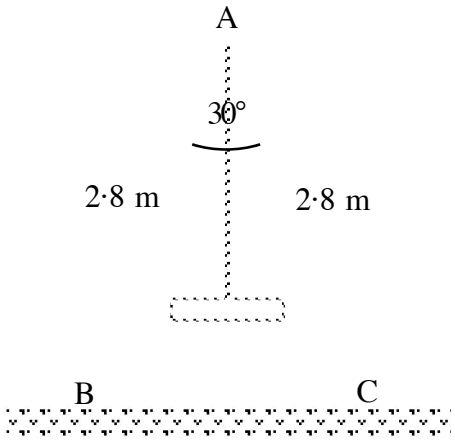
9. This is the metal frame used to support and hold a child's swing.

It is in the shape of an isosceles triangle.

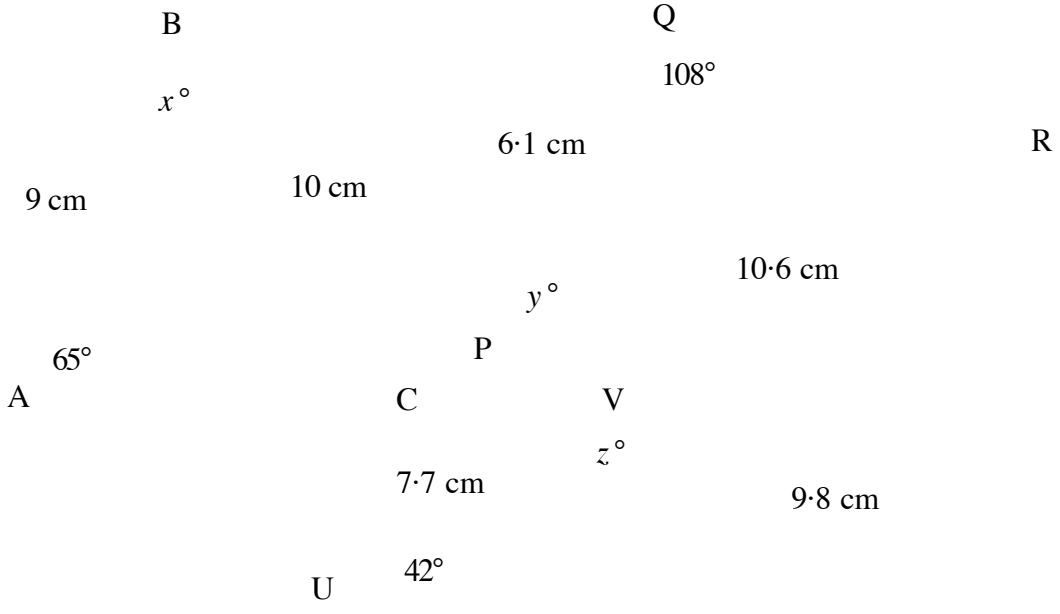
(a) Calculate the size of ∠ABC.

(b) Use the Sine rule to calculate how far apart points B and C are. (Answers to 2 decimal places)

(c) Draw a vertical line through A, creating two right angled triangles and use right angled trigonometry to check your answer to part (b).



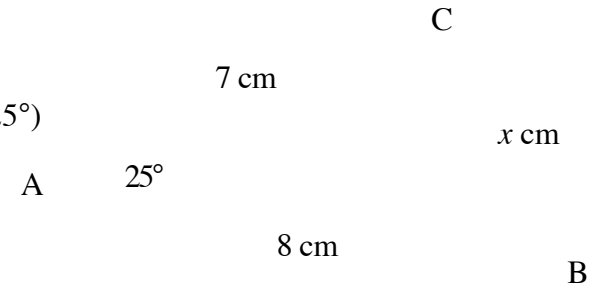
10. Calculate the size of the angles marked $x°$, $y°$ and $z°$. (careful!)



C. Cosine Rule

Exercise 4A

1. Copy and complete the following:



$a^2 = b^2 + c^2 - (2bc \cos A)$

$\Rightarrow x^2 = 7^2 + 8^2 - (2 \times 7 \times 8 \times \cos 25°)$

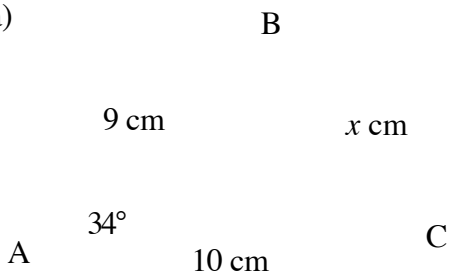
$\Rightarrow x^2 = \ldots + \ldots - (\ldots\ldots)$

$\Rightarrow x^2 = \ldots\ldots$

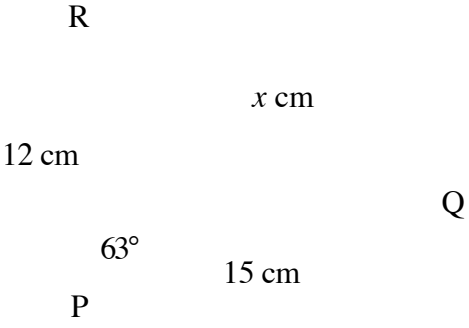
$\Rightarrow x = \sqrt{}$

2. Use the Cosine rule to calculate the size of each side marked x cm here.

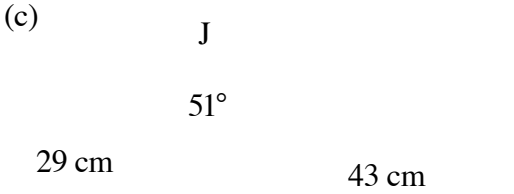
(a)



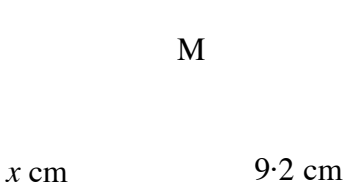
(b)

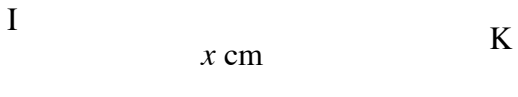


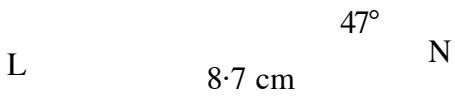
(c)



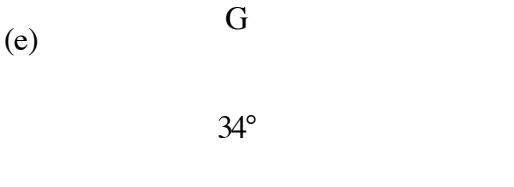
(d)



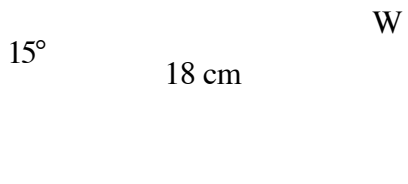


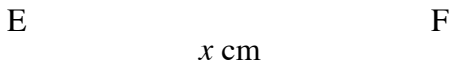


(e)

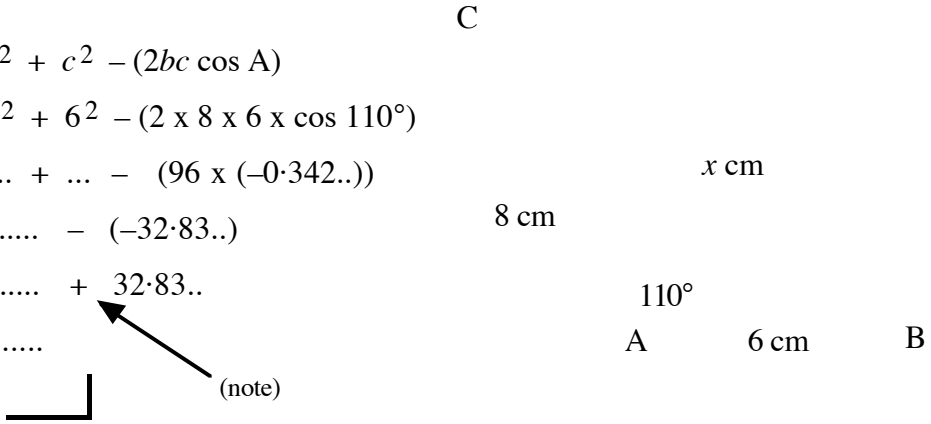


(f)





3. Copy and complete the following:



$a^2 = b^2 + c^2 - (2bc \cos A)$

$\Rightarrow x^2 = 8^2 + 6^2 - (2 \times 8 \times 6 \times \cos 110°)$

$\Rightarrow x^2 = \ldots + \ldots - (96 \times (-0{\cdot}342..))$

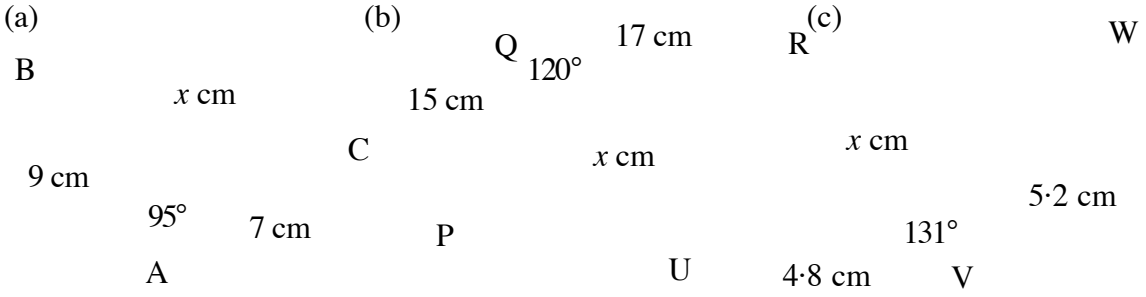
$\Rightarrow x^2 = \ldots\ldots - (-32{\cdot}83..)$

$\Rightarrow x^2 = \ldots\ldots + 32{\cdot}83..$

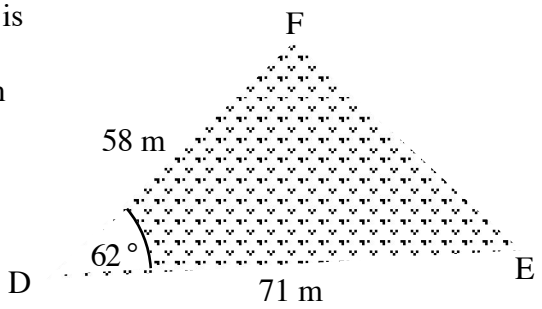
$\Rightarrow x^2 = \ldots\ldots$

$\Rightarrow x =$ ⌟ (note)

4. Calculate the lengths of the sides marked x cm.



5. A farmer owns a piece of fenced land which is triangular in shape.
Calculate the length of the third side and then write down the <u>perimeter</u> of the field.

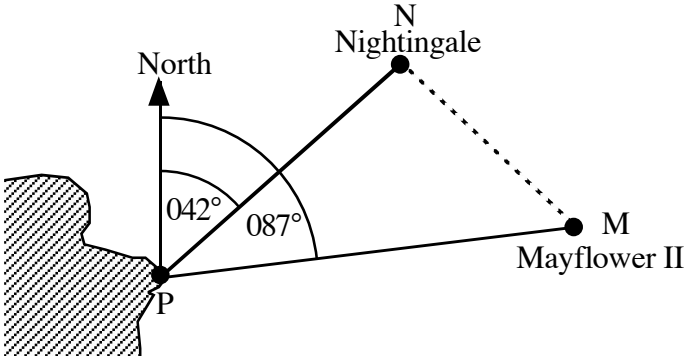


6. Two ships leave Peterborough harbour at 1300. The Nightingale sails at 20 miles per hour on a bearing 042°. The Mayflower II sails at 25 miles per hour on a bearing 087°.

(a) Calculate the size of ∠NMP.

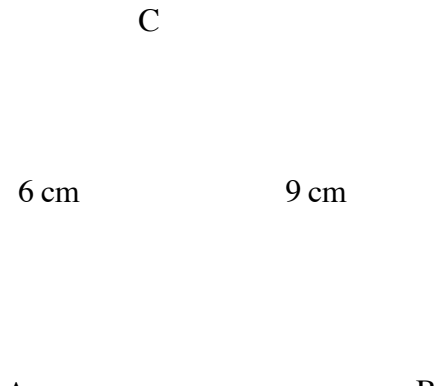
(b) How far apart will the 2 ships be after 1 hour?

(c) How far apart will they be at 1600?



Exercise 4B

1. Copy and complete the following to find ∠BAC:



$a^2 = b^2 + c^2 - (2bc \cos A)$

$\Rightarrow \cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

$\Rightarrow \cos A = \dfrac{6^2 + 7^2 - 9^2}{2 \times 6 \times 7}$

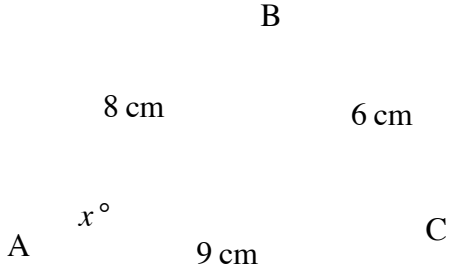
$\Rightarrow \cos A = 0\cdot \ldots\ldots$

$\Rightarrow A = \square$

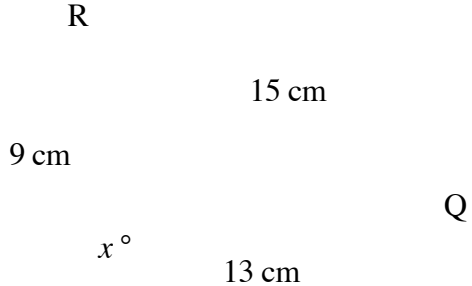
2. Use this 'reverse' form of the Cosine rule to calculate the size of each angle marked $x°$ here.

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

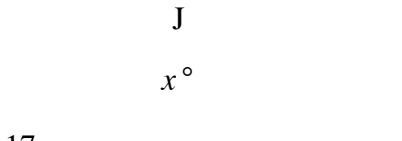
(a)



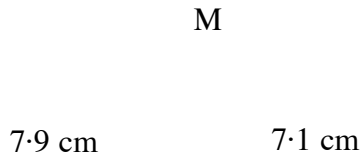
(b)



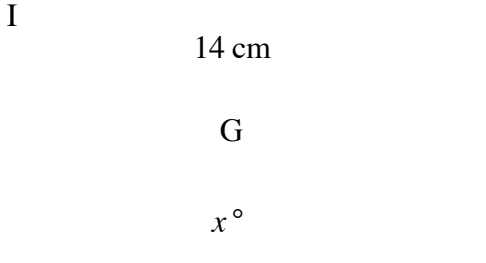
(c)



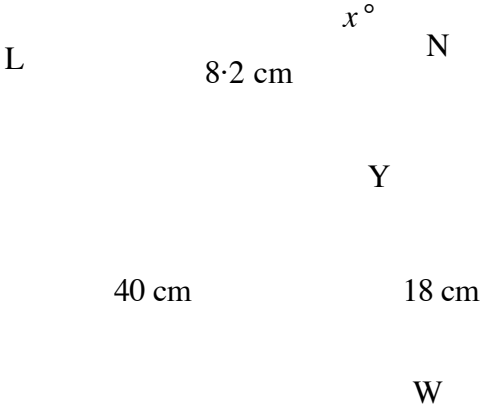
(d)



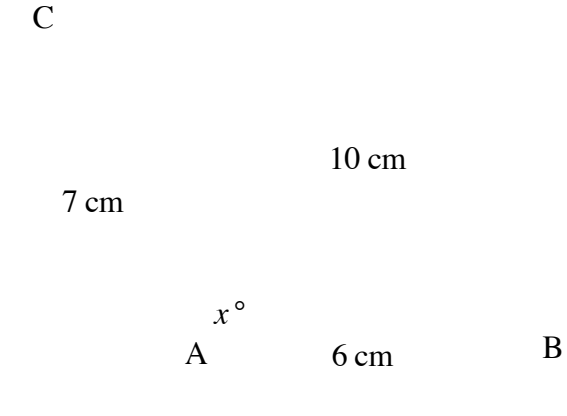
(e)



(f)



3. Copy and complete the following to find ∠BAC:



$a^2 = b^2 + c^2 - (2bc \cos A)$

$\Rightarrow \cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

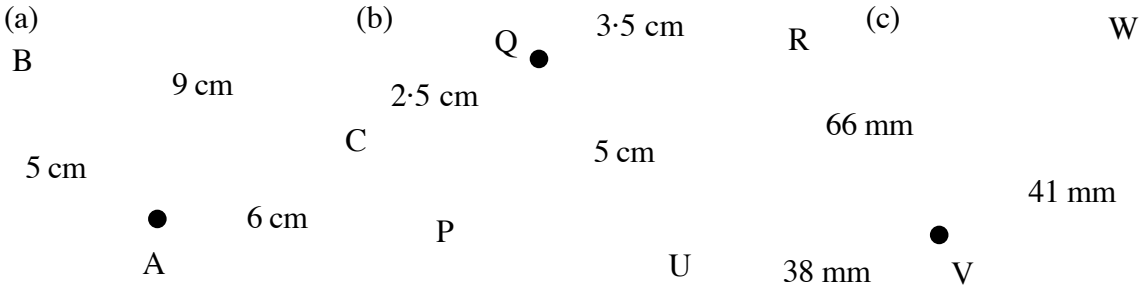
$\Rightarrow \cos A = \dfrac{7^2 + 6^2 - 10^2}{2 \times 7 \times 6}$

$\Rightarrow \cos A = -0{\cdot}178..$

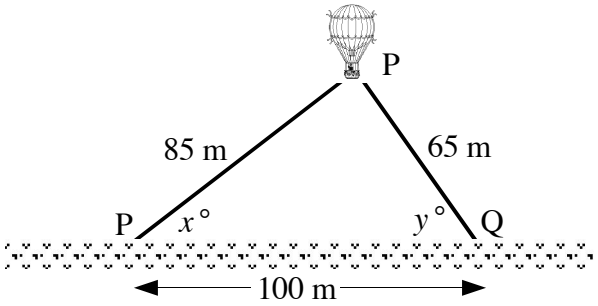
$\Rightarrow A = ?????$

Hint :- try finding SHIFT (or INV) cos (–0·178..)
if you obtain the correct answer of 100·3°, your calculator can handle negatives.
if you obtain the wrong answer of –79·7°, ask your teacher/lecturer for help.

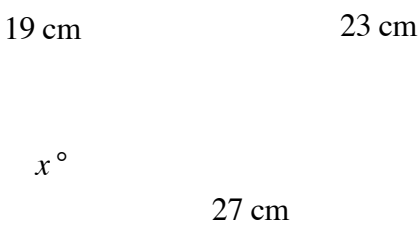
4. Calculate the size of each of the obtuse angles in the following three triangles:



5. Two guy ropes are used to restrain a balloon.
The ropes are 85 metres and 65 metres long, and are tethered at points 100 metres apart.
Calculate the sizes of the two angles marked x ° and y °.



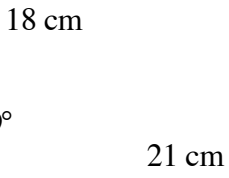
6. This triangular metal plate has its 3 sides as shown.
   (a) Calculate the size of the angle marked x °.
   (b) Calculate the <u>area</u> of the triangular plate.



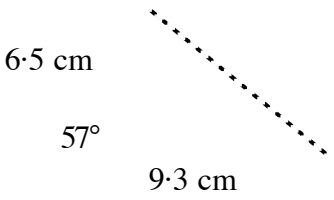
CHECKUP FOR TRIGONOMETRY

1. Write down the values of the following to 3 decimal places:
   (a) sin 200° (b) tan 320° (c) cos (–265°)

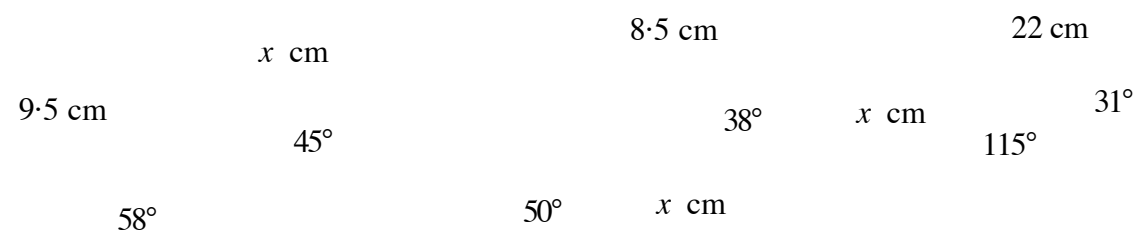
2. Calculate the area of this triangle:



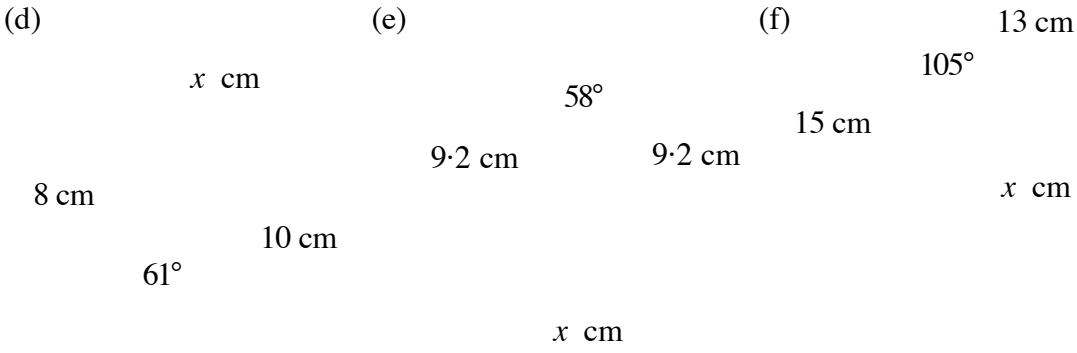
3. Calculate the area of this parallelogram:



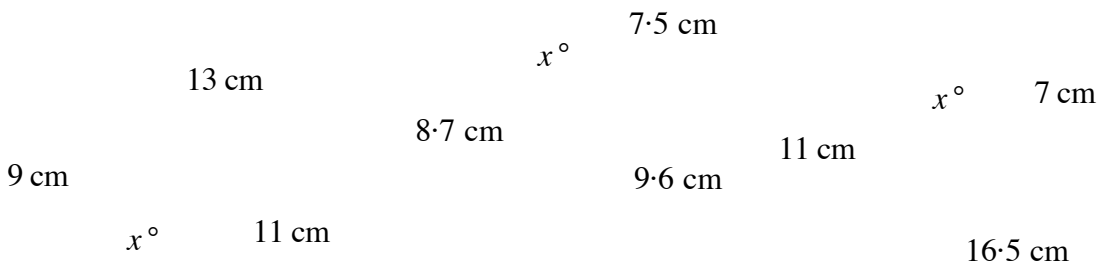
4. Use the Sine Rule or the Cosine rule (2 formats) to calculate the value of x each time here:
   (a) (b) (c)



   (d) (e) (f)

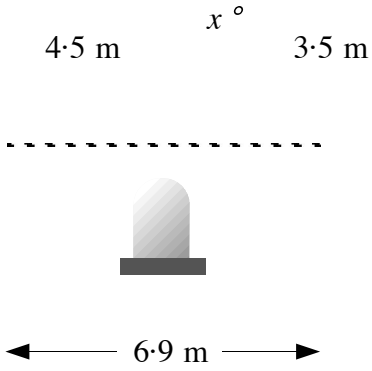


   (g) (h) (i)

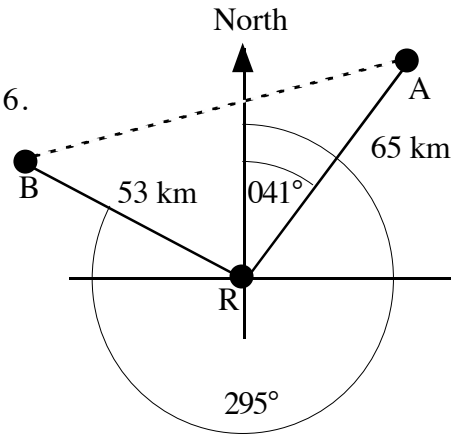


5. The diagram shows the side view of a house with a sloping roof.

Calculate the size of the angle, $x°$, between the two sloping sides of the roof.



6.



From a radar station at R, signals from two ships are picked up.

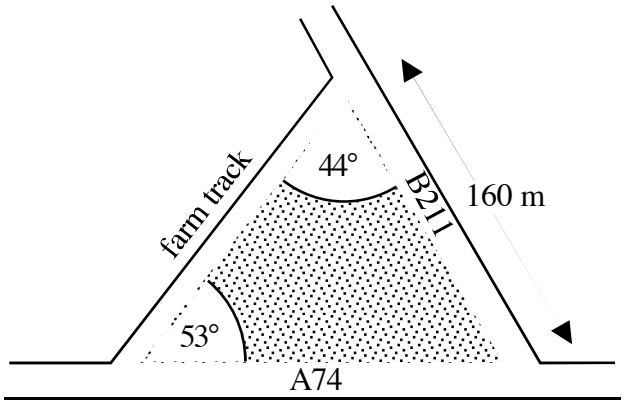
Ship A is on a bearing 041° from R and is 65 kilometres away.

Ship B is on a bearing 295° from R and is 53 kilometres away.

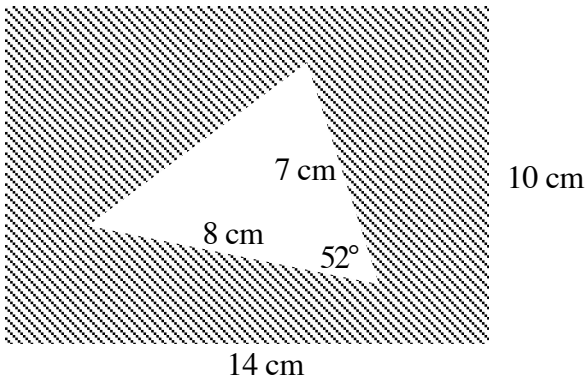
Calculate how far apart the two ships are.

7. A farmer owns a triangular piece of land trapped between 2 main roads and the farm track.

Calculate the length of the farm track to the nearest whole metre.



8. Calculate the shaded area of this rectangular metal plate with a triangular hole cut out of it.



SIMULTANEOUS LINEAR EQUATIONS

By the end of this set of exercises, you should be able to

(a) Construct formulae to describe a linear relationship

(b) Understand the significance of the point of intersection of two graphs

(c) Solve simultaneous linear equations in two variables graphically

(d) Solve simultaneous linear equations in two variables algebraically

SIMULTANEOUS LINEAL EQUATIONS

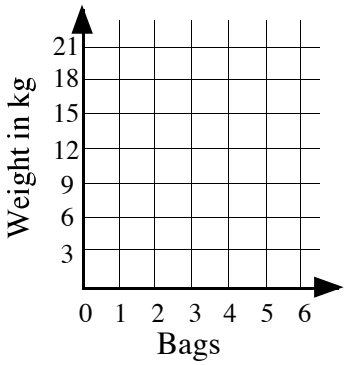
A. Construction of Formula

Exercise 1

1. A greengrocer sells Brussel Sprouts in 3 kilogram bags.
   The table compares the number of bags with the weight of sprouts sold.

Number of Bags (N)	1	2	3	4	5	6
Weight of sprouts (W)	3	6	9	12	15	18

(a) **Copy** and complete: Weight = ... x No. Bags
(b) Write a formula for the weight of sprouts.
(c) Use your formula to find the weight of sprouts in 10 bags.
(d) In your jotter, use your table to plot and join the points on a coordinate diagram like this :–
(e) Extend your graph to show a straight line which passes through the origin.



2. A confectioner sells jelly eels in packs of ten.
   (a) Copy and complete the table:

Number of packs (P)	1	2	3	4	5	6
Number of eels (E)	10					

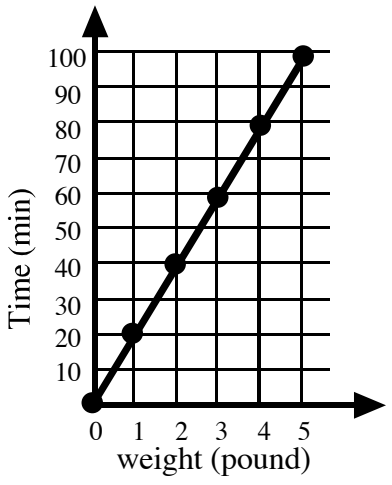
(b) **Copy** and complete :– Number of eels = ... x No. packs
(c) Write a formula for calculating the number of eels.
(d) Use your formula to find the number of eels in 9 packs.
(e) Use your table to plot and join the points on a coordinate diagram.
(f) Extend your graph to show a straight line which passes through the origin.

3. The graph shows cooking times for roast beef.

(a) **Copy** and complete the table:

Weight (W)	1	2	3	4	5	6
Time (T)	20					

(b) Write a formula for the time (T) taken to cook a roast if you know its weight (W).
(c) Use your formula to find the time taken to cook a 10 pound roast .



4. Mr. R. Highet called out Computer Fix to repair his computer. They have a 'call out' charge of £25 plus a charge of £8 per hour.

No. Hours (h)	1	2	3	4	5
Charge £ (C)	33	41	49		

(a) How much do Computer Fix charge for:
(i) 4 hours? (ii) 5 hours?

(b) Write a formula for the charge (C), given the number of hours worked (h).

5. To hire a cement mixer it costs a basic £8 plus £4 for each day you have the machine.

(a) **Copy** and complete the table:

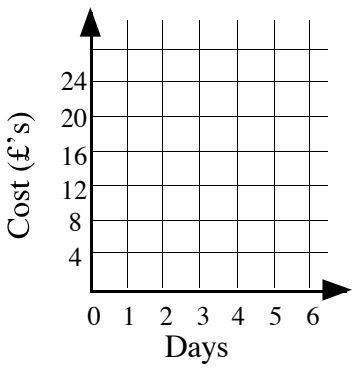
No. Days (D)	1	2	3	4	5
Charge £ (C)	12				

(b) Write a formula for the charge (C) given the number of days (D) for which you have the machine.

(c) In your jotter, use your table to plot and join the points on a coordinate diagram like this:

(d) Extend your graph to cut the vertical (C) axis and give the coordinates of the point where the line cuts that axis.

(e) Explain this point in relation to hiring a cement mixer.



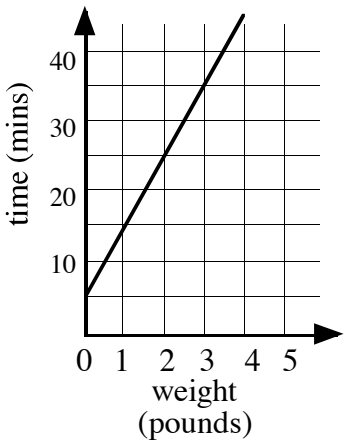
6. The graph shows defrosting times for a chicken.

(a) Using the graph, **copy** and complete the table.

Weight (W pounds)	1	2	3	4	5	6
Time (T min)	15					

(b) Write a formula for the time (T) taken to cook a chicken if you know its weight (W).

(c) Use your formula to find the time taken to cook a 10 pound chicken .

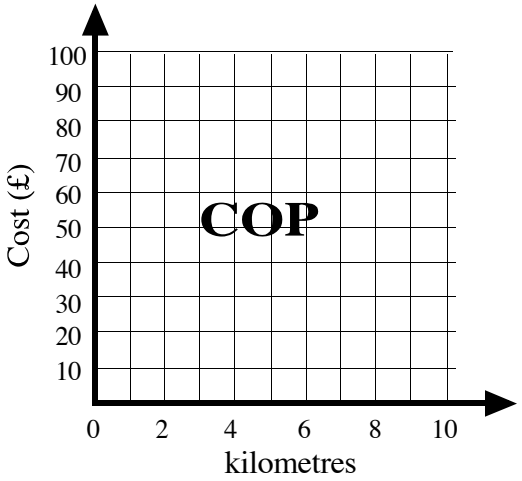


7. Fast Delivery charges £50, plus £5 per kilometre to deliver parcels.

   (a) Write down a formula for the charge £C for a delivery of k kilometres.

   (b) Calculate the charge for a 10 kilometre trip.

   (c) Draw a graph of charges up to 10km, using these scales.

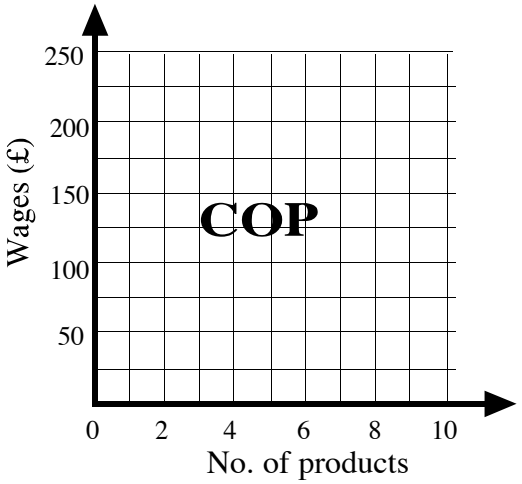


8. Mrs. Divers sells cosmetics.
   She gets paid a basic £80 per week plus £10 each time she sells a product from the new Opius Perfume range.

   (a) Write down a formula for her wage £W for a week in which she sells P products.

   (b) Work out her wage for a for a week in which she sells 20 products.

   (c) Draw a graph of her wages for up to 20 products, using these scales.



9. Mr. McGarrill, the school janitor, is ordering sweeping brushes at £10 each.
   If he pays quickly he finds that he can get a discount of £5 off his <u>total</u> bill.
   (a) **Copy** and complete the table:

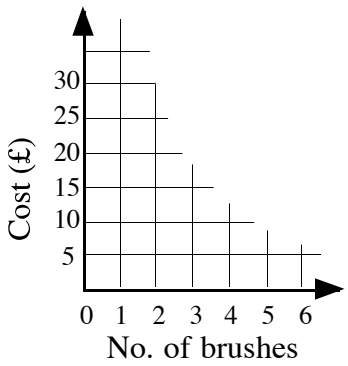
No. Brushes (B)	1	2	3	4	5
Cost £ (C)	5	15	25		

   (b) What is his bill for:

   (i) 4 brushes? (ii) 5 brushes?

   (c) Write a formula for the cost (C) for a number of brushes (B).

   (d) In your jotter, use your table to plot and join the points on a coordinate diagram like this:

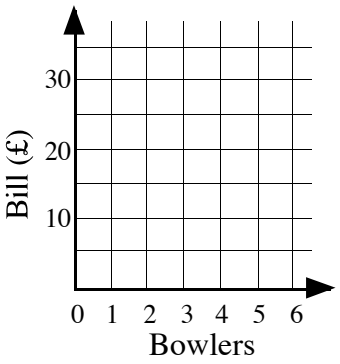


10. A group of adults are having a night out at a ten–pin bowling alley.
The cost is normally £6 each, but a midweek special is giving £4 off the total bill.

(a) Make up a table to show the total bill for 1, 2, 3, 4, 5, 6 bowlers.

(b) Write a formula for the total bill (£T) for a number of bowlers (B).

(c) In your jotter, use your table to plot and join the points on a coordinate diagram like this:



Revision:- Drawing Straight Lines

Exercise 2

For each of the following equations of a straight line:

- choose three points on the line
- plot the points on squared paper, each one on a separate diagram
- draw a straight line through them.

1. $y = x$	2. $y = 3x$	3. $y = x + 1$	4. $y = 2x + 3$
5. $y = 2x - 1$	6. $y = 2 - x$	7. $y = 5$	8. $x = 3$
9. $x + y = 6$	10. $x - y = -2$	11. $2x + y = 0$	12. $y = -x + 1$

B. Solving Simultaneous Linear Equations Graphically

Exercise 3

By drawing the graphs represented by the following equations on squared paper, solve each pair of simultaneous equations.

1. $x + y = 6$ $y = x$	2. $x + y = 4$ $x + 2y = 6$	3. $x - y = 4$ $x - 2y = 6$
4. $x + y = 8$ $x - y = 2$	5. $x + 2y = 5$ $x - y = -1$	6. $y = x + 2$ $y = -x - 4$
7. $x + 3y = 7$ $x - 3y = 1$	8. $y = 2x + 2$ $y = -x - 4$	9. $2x - y = 3$ $y = 5$
10. $2x + y = 4$ $3x + 2y = 9$	11. $3x - 3y = -6$ $3x - 2y = 0$	12. $x + 3y = 8$ $2x - y = -5$

Exercise 4A

1.

Goudie's Car Hire
£40 Deposit + £10 a day

Henry's Rent a Car
£20 per day

(a) **Copy** and complete the tables showing the charges for the two car hire companies.

Goudie's

Number of days	0	1	2	3	4	5	6	7
Cost (£)	40	50	60					

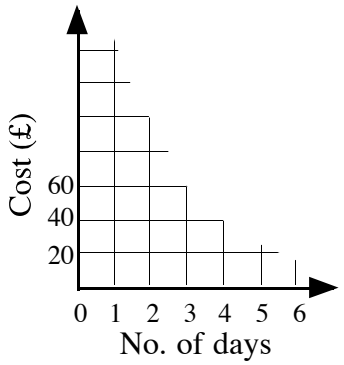
Henry's

Number of days	0	1	2	3	4	5	6	7
Cost (£)	0	20	40					

(b) Draw the straight line graph for both car hire companies on the same coordinate diagram.

(c) The two companies charge the same amount only once. For how many days is this?

(d) Up to how many days is Henry's cheaper?



2. 'Hire a bike in Millport.'

Mr. Dawes charges **£1 deposit plus 50p per hour**.

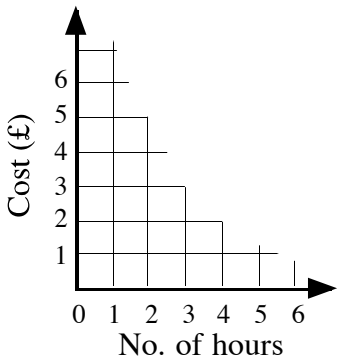
Mr. Beckham charges **No deposit, £1 per hour**.

(a) Make two tables to show the prices for up to 6 hours hire at Dawes' and Beckham's.

(b) Draw the straight line graph for both bicycle hire companies on the same coordinate diagram.

(c) For what number of hours hire is the cost the same at both shops?

(d) If you wanted to hire a bike for 4 hours, which shop would you go to in order to save money?



3. RENT A COMPUTER are offering computers for **£20 deposit, plus £5 per month**.

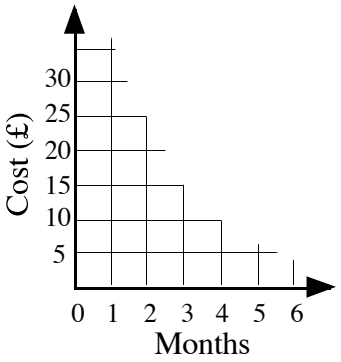
COMPU HIRE are offering similar computers for **£10 per month, with no deposit**.

(a) Make two tables to show the prices for up to 5 months at each place.

(b) Draw the straight line graph for both computer rental companies on the same coordinate diagram.

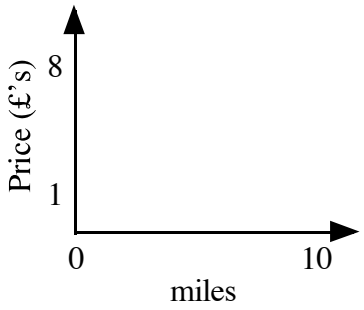
(c) (i) For what number of months is the cost the same at both shops?

(ii) What price is this?



4. BLACK CAB TAXI COMPANY charge **50p** per mile.
RED TAXIS charge **£2** for any journey up to **4 miles**, then **£1** per mile for each additional mile.

(a) Make two tables to show the prices for up to a 10 mile journey at both firms.
(b) Draw the straight line graph for both taxi companies on the same coordinate diagram.
(c) For how many miles is the cost the same at both firms?
(d) You are travelling only 2 or 3 miles – which taxi company would you phone to save money?



Exercise 4B

1. Third Lanark v Leith Athletic

Adult Charge £x

Child Charge £y

One adult and one child paid £8 to attend this football match.

$x + y = 8$

Two adults and one child paid £13.

$2x + y = 13$

(a) Draw the lines $x + y = 8$ and $2x + y = 13$ on the same coordinate diagram using suitable points on each line.
(b) Write down the coordinates of the point of intersection.
(c) What is significant about this point in terms of prices to get into the match?
(d) What was the charge for 10 adults and 10 children at this match?

2. The professional at Worthwent Golf Club prices her goods as follows:

Golf Balls £x Golf Gloves £y

Arnold bought 2 golf balls and 1 golf glove for £8. $2x + y = 8$
Tiger bought 4 golf balls and 1 golf glove for £12. $4x + y = 12$

(a) Draw the lines $2x + y = 8$ and $4x + y = 12$ on the same coordinate diagram using suitable points on each line.
(b) Write down the coordinates of the point of intersection.
(c) What was the cost of a golf ball?
(d) What was the cost of a golf glove?
(e) What does the professional charge for 3 golf balls and 3 golf gloves?

3. 2 jotters and 2 pencils cost 80p. 1 jotter and 3 pencils cost 60p.
Let the cost of a jotter be x pence and the cost of a pencil be y pence.
One equation from the data given is $2x + 2y = 80$.
(a) Write down the other equation in terms of x and y.
(b) Draw the two straight lines which the equations represent on the same coordinate diagram using suitable points on each line.
(c) Use your graph to find the cost of a jotter and the cost of a pencil.

4. 1 packet of Weedo and 1 packet of slug pellets costs £5.
   1 packet of Weedo and 3 packets of slug pellets costs £9.
   Let the cost of a packet of Weedo be £x and the cost of a packet of slug pellets be £y.
   (a) Write down two equations in terms of x and y.
   (b) Draw the two straight lines which the equations represent on the same coordinate diagram using suitable points on each line.
   (c) Use your graph to find the cost of a packet of Weedo and the cost of a bottle of slug pellets.

5. Mary bought 3 T–shirts and 2 bottles of colour dye for £12.
   Sally bought 2 of the T–shirts and 5 bottles of colour dye for £30.
   Let the cost of a T–shirt be £x and the cost of a bottle of colour dye be £y.
   (a) Write down two equations in terms of x and y.
   (b) Draw the two straight lines which the equations represent on the same coordinate diagram using suitable points on each line.
   (c) Use your graph to find the cost of a T–shirt and the cost of a bottle of colour dye.

6. The total cost of two books is £10 and the difference in their cost is £2.
   Let the cost of a one book be £x and the cost of the other book be £y .
   (a) Write down two equations in terms of x and y.
   (b) Draw the two straight lines which the equations represent on the same coordinate diagram using suitable points on each line.
   (c) Use your graph to find the cost of each book.

C. Solving Simultaneous Linear Equations Algebraically

Exercise 5A

Solve these simultaneous equations by eliminating x or y, etc.

1. $x + y = 12$
   $x - y = 8$

2 $x + y = 6$
   $x - y = 4$

3. $x + y = 10$
   $x - y = 8$

4. $x + 2y = 6$
   $x - 2y = 2$

5. $a + 4d = 9$
   $a - 4d = 1$

6. $3r + t = 10$
   $3r - t = 2$

7. $5p + q = 4$
   $2p + q = 1$

8. $6u + 6w = 6$
   $4u + 6w = 6$

9. $7x - 3y = 1$
   $4x - 3y = -2$

10. $4g - 5h = 13$
    $3g - 5h = 11$

11. $5e - 2f = 8$
    $-e + 2f = 0$

12. $-3x - 4y = 3$
    $3x + y = 6$

Exercise 5B

Solve these simultaneous equations by first multiplying both sides of the equations by suitable numbers.

1. $x + 2y = 4$
   $2x - y = 3$

2. $3a + d = 9$
   $a - 2d = 3$

3. $4e - f = 11$
   $e + 2f = 5$

4. $g + 2h = 7$
   $2g - h = 9$

5. $m + 3n = 2$
   $2m - n = 4$

6. $5p + q = 3$
   $p - 2q = 5$

7. $3r + 2s = 1$
   $r + s = 0$

8. $4t + 2u = 4$
   $t + u = 0$

9. $3v - 4w = 13$
   $v + w = 2$

10. $x - y = 4$
    $3x - 2y = 8$

11. $5x - 2y = -1$
    $x - 3y = 5$

12. $x - 3y = 1$
    $2x - y = 7$

Exercise 5C

Solve these simultaneous equations by first multiplying both sides of the equations by suitable numbers.

1. $2p - 3q = 1$
   $3p + 2q = 8$

2. $2x + 4y = 14$
   $7x + 3y = 27$

3. $2v + 3w = 0$
   $v - w = 5$

4. $7a + 4d = 1$
   $5a + 2d = -1$

5. $2r - 3s = 12$
   $3r - 2s = 13$

6. $5x - 8y = 0$
   $4x - 3y = -17$

7. $3g + 2h - 6 = 0$
   $g - h - 1 = 1$

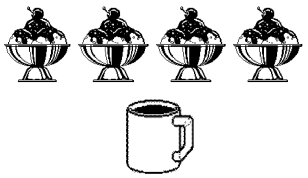
8. $3m + 5n - 23 = 0$
   $5m + 2n - 13 = 0$

9. $3f - 5g - 11 = 2$
   $2f + 4g - 9 = 7$

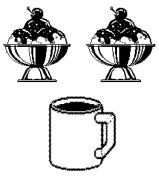
Exercise 5D

Write down a pair of simultaneous equations for each picture, then solve them to answer the question. (Use £x and £y to represent the cost of one of each item each time).

1.



Total cost £9



Total cost £5

Find the cost of: (a) one ice cream sundae. (b) one mug of cocoa.

2.

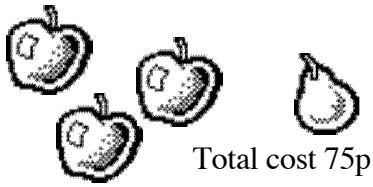
Total cost £24

Total cost £21

Find the cost of: (a) one hammer. (b) one spanner.

3. 

Total cost 55p



Total cost 75p

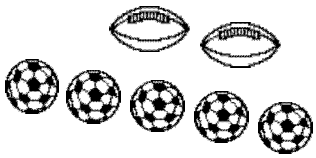
Find the cost of: (a) one apple. (b) one pear.

4. 

Total cost £3·50

Total cost £2·50

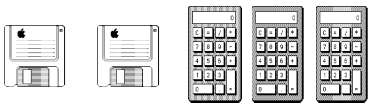
Find the cost of: (a) one frothy drink. (b) one slice of cake.

5. 

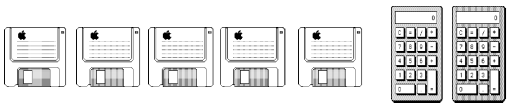
Total cost £90

Total cost £110

Find the cost of: (a) one football. (b) one rugby ball.

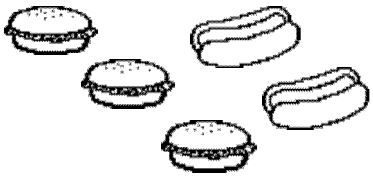
6. 

Total cost £7

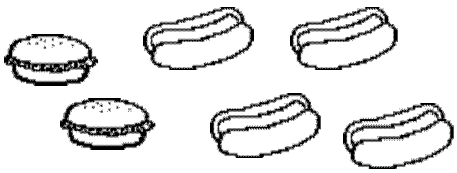


Total cost £6·50

Find the cost of: (a) one disk. (b) one calculator.

7. 

Total cost £6·50



Total cost £7

Find the cost of: (a) one hot dog. (b) one hamburger.

8. At a supermarket, a lady paid £2·70 for 6 red peppers and 5 corn on the cobs.
At the same supermarket, a man paid £1·20 for 3 red peppers and 2 corn on the cobs.

Find the cost of: (a) one pepper. (b) one corn stick.

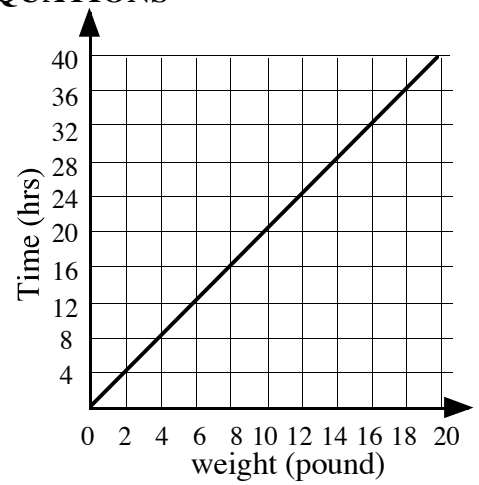
9. At a newsagent, a boy paid £1·10 for 2 memo pads and 7 pencils.
At the same shop, a girl paid £1·60 for 7 memo pads and 2 pencils.

Find the cost of: (a) one memo pad. (b) one pencil.

10. An adult's ticket for the cinema is £3 more than a child's.
The adult's ticket is also twice that of the child's.
Let the price of an adult's ticket be £x and the price of a child's ticket be £y.
Form a pair of simultaneous equations and solve them to find the price of each ticket.

CHECKUP FOR SIMULTANEOUS LINEAR EQUATIONS

1. The graph shows defrosting times at room temperature for Christmas turkey.



(a) **Copy** and complete the table:

Weight (W)	0	2	4	6	8	10	12	14	16	18	20
Time (T)	0	4									

(b) Write a formula for the time (T) taken to defrost a turkey if you know its weight (W).

(c) Use your formula to find the time taken to defrost a 15 pound turkey.

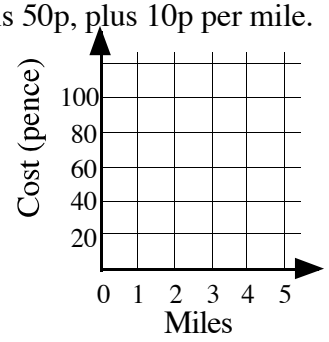
2. Pizza Point will deliver pizzas to your door. The charge is 50p, plus 10p per mile.

(a) Write down a formula for the charge C pence for a delivery of M miles.

(b) Work out the charge for a 5 mile delivery.

(c) Draw a graph of charges up to 5 miles, using the scales shown.

(d) What would be the charge for a 10 mile delivery ?



3. By drawing graphs of these equations on squared paper, solve each pair of simultaneous equations.

(a) $x + y = 8$
$y = x$

(b) $x + 2y = 7$
$4x - y = 10$

(c) $x + 3y = 0$
$x - 2y = 5$

4. HIGH FLY offer balloon trips at £10 basic, plus £2 per kilometre travelled.

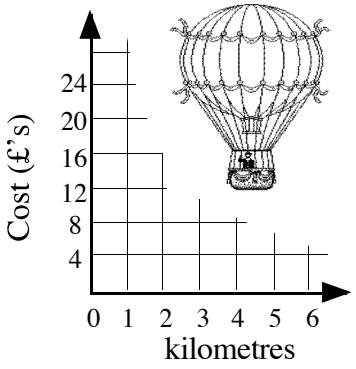
FLIGHT BALLOONS offer the same trips at £4 per kilometre, with no other charges.

(a) Make two tables to show the prices for up to a trip of 6 km with both companies.

(b) Draw the straight line graph for both companies on the same coordinate diagram.

(c) (i) How many kilometres can you travel for the same price at both businesses?

(ii) What price is this?



5. Terry bought a bottle of shampoo and a bottle of conditioner for £6.
Lesley bought 4 bottles of shampoo and a bottle of conditioner for £12.
Let the cost of a bottle of shampoo be £x and the cost of a bottle of conditioner be £y.

(a) Write down two equations in terms of x and y.

(b) Draw the two straight lines which the equations represent on the same coordinate diagram using suitable points on each line.

(c) Use your graph to find the cost of a bottle of shampoo and the cost of a bottle of conditioner.

6. Solve these simultaneous equations algebraically:

(a) $x + y = 20$
$x - y = 4$

(b) $x - 3y = -1$
$x + 3y = 11$

(c) $2x + y = 10$
$-2x + y = -10$

(d) $v + 3w = 7$
$2v - w = 0$

(e) $2p + 3q = 19$
$4p - 7q = -27$

(f) $2x - 3y = 1$
$3x + 2y = -5$

(g) $5s + 3t = 19$
$7s - 2t = 8$

(h) $4x - 3y - 1 = 4$
$3x + 4y - 10 = 0$

7. Write down a pair of simultaneous equations for each picture, then solve them to answer the question. (Use £x and £y to represent the cost of one of each item).

(a)

Total cost £36

Total cost £28

Find the cost of: (i) one spider. (ii) one turtle.

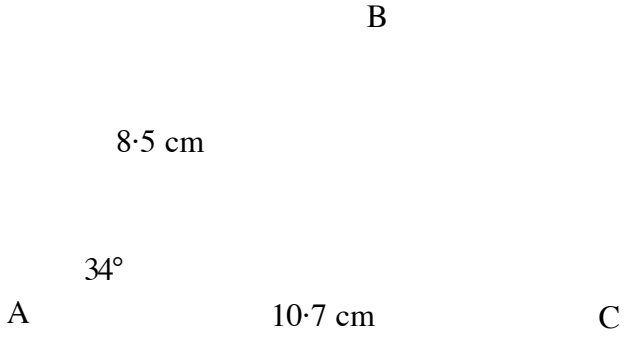
(b) 5 pairs of compasses and 2 pairs of scissors together cost £2·30.
3 pairs of compasses along with 3 pairs of scissors cost £2·10.

Find the cost of: (i) one pair of compasses. (ii) one pair of scissors .

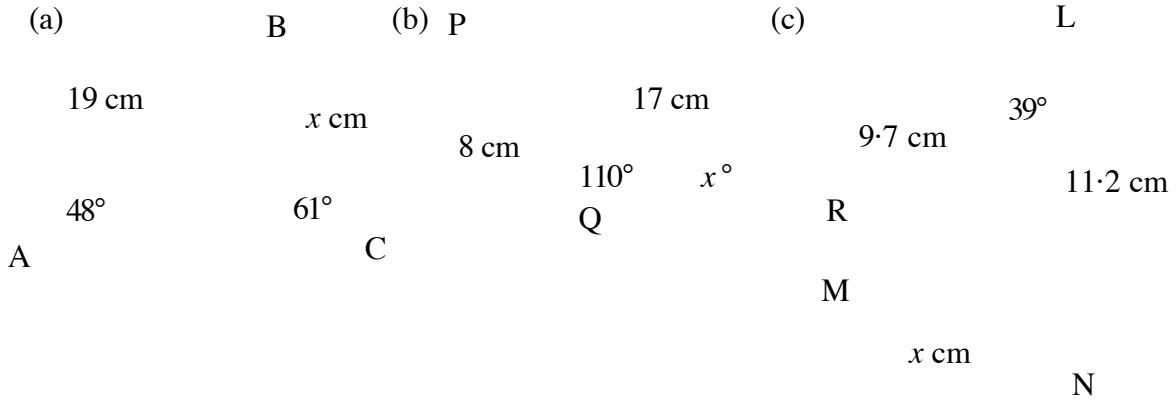
8. The sum of two whole numbers is 112, and their difference is 36.
Form a pair of simultaneous equations and solve them to find the two numbers.

SPECIMEN ASSESSMENT QUESTIONS

1. Calculate the area of this triangle:



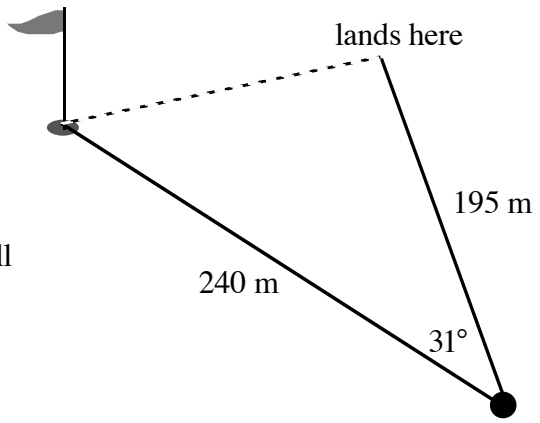
2. Use the Sine rule or Cosine rule to calculate the value of x each time.



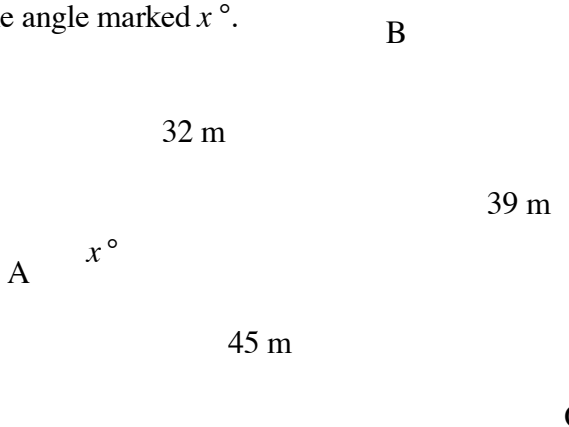
3. A golfer tees off and aims his shot for the third hole, a distance of 240 metres away.

   Unfortunately, he slices his ball and it ends up at the position shown opposite.

   How far away to the nearest metre is his ball from the flag?



4. Calculate the size of the angle marked x °.



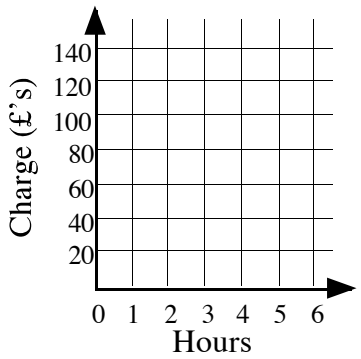
5. Mrs. Doherty called out Hoover Repair to repair her washing machine.
They have a 'call out' charge of £30 plus a charge of £20 per hour.

(a) How much do Hoover Repair charge for:

(i) 1 hour? (ii) 2 hours? (iii) 3 hours? (iv) 4 hours? (v) 5 hours?

(b) Write a formula for the charge (C), given the number of hours worked (h).

(c) Use your information to plot and join the points on a coordinate diagram like this:



6. Draw the graphs of the equations on squared paper using suitable scales and solve each pair of simultaneous equations.

(a) $x + y = 10$
$y = x - 2$

(b) $x + 2y = 80$
$3x + y = 90$

7. The price for 1 adult and 1 child to play a game of pitch and putt is £4.
2 adults and 4 children were charged £10.

Let the adult price be £x and the child price be £y.

(a) Write down two equations in terms of x and y.

(b) Draw the two straight lines which the equations represent on the same coordinate diagram using suitable points on each line.

(c) Use your graph to find the price of an adult's ticket and the price of a child's ticket.

8. Solve these simultaneous equations algebraically:

(a) $5x + y = 4$
$2x + y = 1$

(b) $x + 2y = 9$
$2x - y = 8$

(c) $4x - 3y = 10$
$3x + 4y = 20$

9. Write down a pair of simultaneous equations for the picture, then solve them to answer the question. (Use £x and £y to represent the cost of one item each time).

Total cost £2·60

Total cost £2·20

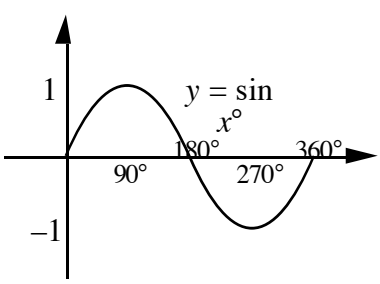
Find the cost of: (i) one can of coke. (ii) one bag of chips.

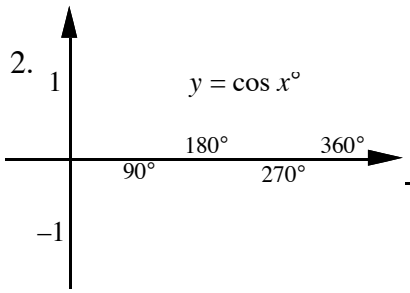
ANSWERS TO MATHEMATICS 2 (INT 2)

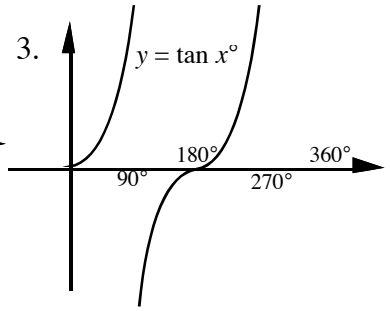
Trigonometry

Exercise 1A

1. (a) 0·00 0·34 0·64 0·87 0·98 1·00 0·98 0·87 0·64 0·34 0·00
–0·34 –0·64 –0·87 –0·98 –1·00 –0·98 –0·87 –0·64 –0·34 0·00



2.


3.


Exercise 1B

1. (a) 0·423 (b) –0·087 (c) –3·271 (d) –0·342 (e) 0·707
(f) 0·017 (g) –0·5 (h) –0·5 (i) 1 (j) –0·866
(k) –1 (l) –0·776 (m) –3·732 (n) –0·940 (o) 0 (p) 1

Exercise 2

1. Method : (a) h = 9·51 (b) 57·06 cm^2 Method 2: —> 57·06 cm^2
2. (a) 14·1 cm^2 (b) 56·6 cm^2 (c) 30·8 cm^2
(d) 71·6 cm^2 (e) 100·5 cm^2 (f) 2·6 cm^2
3. (a) 25·7 cm^2 (b) 25·7 cm^2 same answer
4. (a) 18·2 cm^2 (b) 18·2 cm^2 same answer because sin 53° = sin 127°
5. 1152.6 cm^2 6. 117·7 cm^2 7 (a) 215·7 cm^2 (b) 26·2 cm^2

Exercise 3

1. a = 10·4 cm
2. (a) 17·6 cm (b) 14·0 cm (c) 7·6 cm (d) 8·2 cm (e) 13·2 cm (f) 29·8 cm
3. (a) 40° (b) 13·8 cm
4. (a) 67°; 5·6 cm (b) 49°; 9·2 cm (c) 29°; 13·3 cm
5. 0.836, 56·8° 6. (a) 37·6° (b) 76·1° (c) 50·6° (d) 21·6°
7. 58·4° 8. 23·9 km 9. (a) 75° (b) 1·45 m (c) 1·45 m
10. (a) x = 60·3 (b) y = 38·8 (c) z = 106·3

Exercise 4A

1. x = 3·39
2. (a) 5·6 cm (b) 14·3 cm (c) 33·5 cm (d) 7·2 cm (e) 4·4 cm (f) 5·3 cm
3. x = 11·5 cm 4. (a) 11·9 cm (b) 27·7 cm (c) 9·1 cm
5. 67·4 m; 196·4 m 6. (a) 45° (b) 17·8 km (c) 53·5 km

Exercise 4B

1. 87·3°
2. (a) 40·8° (b) 83·9° (c) 47° (d) 61·7° (e) 54·0° (f) 26·7°
3. 100·3°
4. (a) 109·5° (b) 111·8° (c) 113·3°
5. $x = 40{\cdot}1°$, $y = 57{\cdot}4°$
6. (a) $x = 56{\cdot}9°$ (b) Area $= 214{\cdot}8$ cm^2

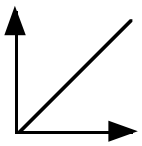
Checkup for Trigonometry

1. (a) –0·342 (b) –0·839 (c) –0·087
2. 91.6 cm^2
3. 50·7 cm^2
4. (a) 11·4 cm (b) 11·1 cm (c) 12·5 cm (d) 9·3 cm (e) 8·9 cm
   (f) 22·2 cm (g) 80·4° (h) 72·3° (i) 131·6°
5. 118·7°
6. 94·5 km
7. 199 m
8. 117·9 cm^2

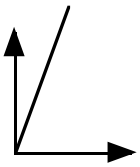
Simultaneous Linear Equations

Exercise 1

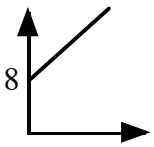
1. (a) 3 (b) W = 3N (c) 30kg (d)(e)



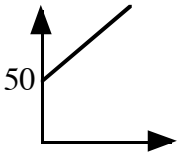
2. (a) 1/10 2/20 3/30 4/40 5/50 6/60 in table (b) 10 (c) E = 10P (d) 90
   (e) (f)



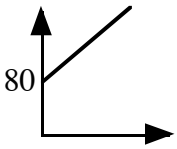
3. (a) 1/20 2/40 3/60 4/80 5/100 6/120 in table (b) T = 20W (c) 200 mins
4. (a) £57 £65 (b) C = 8h + 25
5. (a) 1/12 2/16 3/20 4/24 5/28 in table (b) C = 4D + 8 (c)
   (d) (0,8) (e) Costs £8 before even paying for any days !!



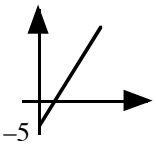
6. (a) 1/15 2/25 3/35 4/45 5/55 6/65 in table (b) T = 10W + 5
   (c) 105 mins
7. (a) C = 5k + 50 (b) £100 (c)



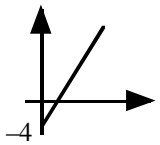
8. (a) W = 10P + 80 (b) £280 (c)



9. (a) 1/5 2/15 3/25 4/35 5/45 in table
   (b) £35; £45 (c) C = 10B – 5
   (d)



10. (a) 1/2 2/8 3/14 4/20 5/26 6/32 in table (b) T = 6B – 4 (c)



Exercise 2

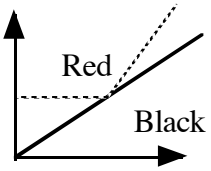
1. Graph of a straight line through (0,0), (1,1) (2,2) etc.
2. Graph of a straight line through (0,0), (1,3) (2,6) etc.
3. Graph of a straight line through (0,1), (1,2) (2,3) etc.
4. Graph of a straight line through (0,3), (1,5) (2,7) etc.
5. Graph of a straight line through (0,–1), (1,1) (2,3) etc.
6. Graph of a straight line through (0,2), (1,1) (2,0) etc.
7. Graph of a straight line through (0,5), (1,5) (2,5) etc.
8. Graph of a straight line through (3,0), (3,1) (3,2) etc.
9. Graph of a straight line through (0,6), (1,5) (2,4) etc.
10. Graph of a straight line through (0,2), (1,3) (2,4) etc.
11. Graph of a straight line through (0,0), (1,–2) (2,–4) etc.
12. Graph of a straight line through (0,1), (1,0) (2,–1) etc.

Exercise 3

1. (3,3) 2. (2,2) 3. (2,–2) 4. (5,3) 5. (1,2) 6. (–3,–1) 7. (4,1)
8. (–2,–2) 9. (4,5) 10. (–1,6) 11. (4,6) 12. (–1,3)

Exercise 4A

1. (a) Goudies 0/40 1/50 2/60 3/70 4/80 5/90 6/100 7/110
   Henry's 0/0 1/20 2/40 3/60 4/80 5/100 6/120 7/140
   (b) Straight lines crossing at (4,80)
   (c) 4 days (d) 3 days
2. (a) Dawes 0/1 1/1·50 2/2 3/2·50 4/3 5/3·50 6/4
   Beckams 0/0 1/1 2/2 3/3 4/4 5/5 6/6
   (b) Straight lines crossing at (2,2) (c) 2 hours (d) Dawes
3. (a) Rent a Computer 0/20 1/25 2/30 3/35 4/40 5/45
   Compu Hire 0/0 1/10 2/20 3/30 4/40 5/50
   (b) Straight lines crossing at (4,40) (c) 4 £40
4. (a) Black 0/0 1/0·5 2/1 3/1·5 4/2 5/2·5 6/3 7/3·5 8/4 9/4·5 10/5
   Red 0/2 1/2 2/2 3/2 4/2 5/3 6/4 7/5 8/6 9/7 10/8
   (b) Lines crossing at (4,2)
   (c) 4 miles
   (d) Black Cab



Exercise 4B

1. (a)(b) Straight lines crossing at (5,3) (c) £5 adult £3 child (d) £80
2. (a)(b) Straight lines crossing at (2,4) (c) £2 (d) £4 (e) £18
3. (a) $x + 3y = 60$ (b) Straight lines crossing at (30,10) (c) jotter 30p pencil 10p
4. (a) $x + y = 5$ $x + 3y = 9$ (b) Straight lines crossing at (3,2) (c) Weedo £3 slug £2
5. (a) $3x + 2y = 12$ $2x + 5y = 30$ (b) Straight lines crossing at (0,6) (c) shirt free dye £6
6. (a) $x + y = 10$ $x - y = 2$ (b) Straight lines crossing at (6,4) (c) £6 and £4

Exercise 5A

1. (10,2)	2. (5,1)	3. (9,1)	4. (4,1)	5. (5,1)
6. (2,4)	7. (1,–1)	8. (0,1)	9. (1,2)	10. (2,–1)
11. (2,1)	12. (3,–3)			

Exercise 5B

1. (2,1)	2. (3,0)	3. (3,1)	4. (5,1)	5. (2,0)
6. (1,–2)	7. (1,–1)	8. (2,–2)	9. (3,–1)	10. (0,–4)
11. (–1,–2)	12. (4,1)			

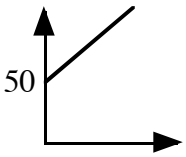
Exercise 5C

1. (2,1)	2. (3,2)	3. (3,–2)	4. (–1,2)	5. (3,–2)
6. (–8,–5)	7. (2,0)	8. (1,4)	9. (6,1)	

Exercise 5D

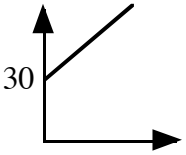
1.	$4x + y = 9$	$2x + y = 5$	ice cream £2	cocoa £1
2.	$3x + 2y = 24$	$2x + 3y = 21$	hammer £6	spanner £3
3.	$2x + y = 55$	$3x + y = 75$	apple 20p	pear 15p
4.	$2x + y = 3{\cdot}50$	$x + 2y = 2{\cdot}50$	drink £1·50	cake 50p
5.	$5x + 2y = 90$	$5x + 3y = 110$	football £10	rugby ball £20
6.	$2x + 3y = 7$	$5x + 2y = 6{\cdot}50$	disk 50p	calculator £2
7.	$3x + 2y = 6{\cdot}50$	$2x + 4y = 7$	hot dog £1	hamburger £1·50
8.	$6x + 5y = 2{\cdot}70$	$3x + 2y = 1{\cdot}20$	pepper 20p	corn 30p
9.	$2x + 7y = 1{\cdot}10$	$7x + 2y = 1{\cdot}60$	pad 20p	pencil 10p
10.	$x - y = 3$	$x = 2y$ or equivalent	adult £6	child £3

Checkup for Simultaneous Linear Equations

1. (a) 0/0 2/4 4/8 6/12 8/16 10/20 12/24 14/28 16/32 18/36 20/40 in table
   (b) T = 2W (c) 30 hours
2. (a) C = 10M + 50 (b) 100p (c) 

(d) 150p
3. (a) (4,4) (b) (3,2) (c) (3,–1)
4. (a) High Fly 0/10 1/12 2/14 3/16 4/18 5/20 6/22 in table
   Flight Balloons 0/0 1/4 2/8 3/12 4/16 5/20 6/24 in table
   (b) Straight lines crossing at (5,20) (c) 5km £20
5. (a) $x + y = 6$ $4x + y = 12$ (b) Straight lines crossing at (2,4) (c) Sham £2 Cond £4
6. (a) (12,8) (b) (5,2) (c) (5,0) (d) (1,2) (e) (2,5)
   (f) (–1,–1) (g) (2,3) (h) (2,1)
7. (a) $3x + y = 36$ $2x + y = 28$ spider £8 turtle £12
   (b) $5x + 2y = 2{\cdot}30$ $3x + 3y = 2{\cdot}10$ compasses 30p scissors 40p
8. 74 & 38

Specimen Assessment Questions

1. 25·4 cm^2
2. (a) 16·1 cm (b) 26·2° (c) 7·1 cm
3. 124 m
4. 58·0°
5. (a) £50 £70 £90 £110 £130 (b) C = 20h + 30 (c) 

6. (a) (6,4) (b) (20,30)
7. (a) $x + y = 4$ $2x + 4y = 10$ (b) Straight lines crossing at (3,1) (c) Adult £3 Child £1
8. (a) (1,–1) (b) (5,2) (c) (4,2)
9. (a) $3x + y = 2{\cdot}60$ $x + 2y = 2{\cdot}20$ coke 60p chips 80p