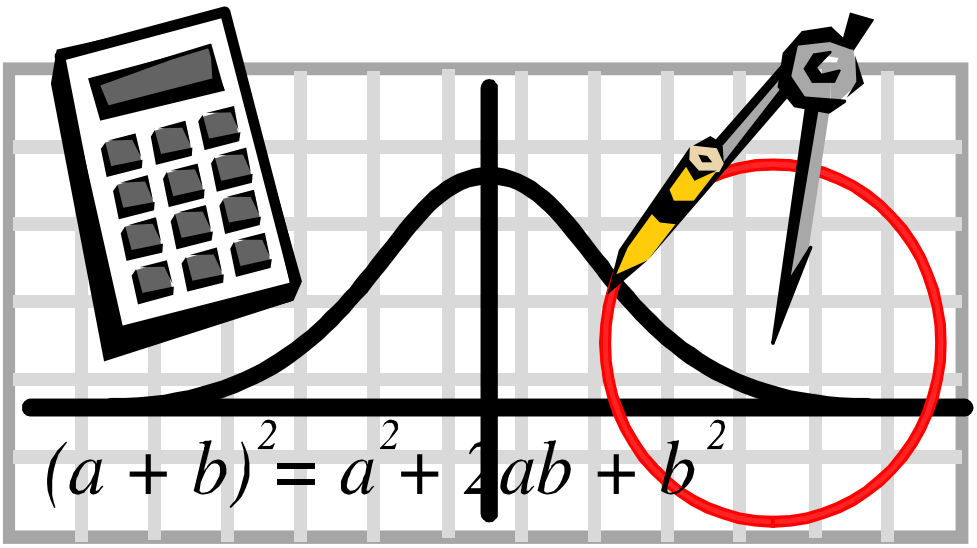
Auchinleck Academy

Maths Department

National 5

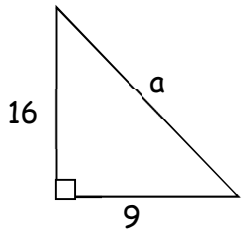
Homework

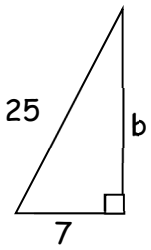


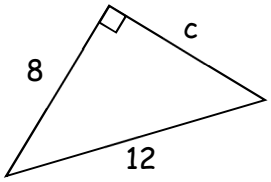
MATHS

Pythagoras
Topic Homework 1.1

1. Calculate the missing side in each of these right-angled triangles correct to one decimal place.

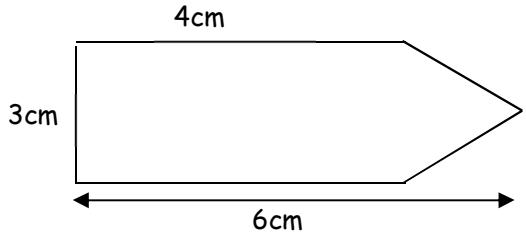




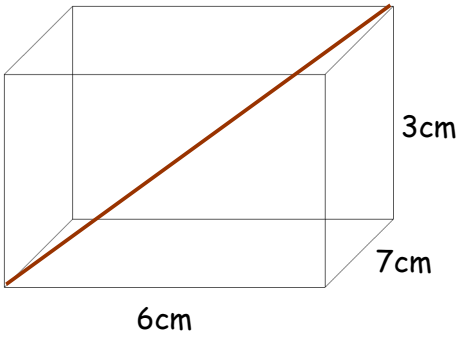


2. How far apart are the points A(1,1) and B(8,5), correct to one decimal place?

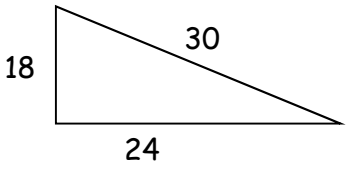
3. What is the perimeter of this label?



4. Calculate the length of the space diagonal



5. Is this triangle right-angled?



Brackets & Factorising
Topic Homework 1.2a

1 Expand and simplify where possible:

a) $9(4m + 2)$ b) $4(4h + 5) + 11$ c) $6(8x - 12) - 15x$

d) $-4(2x- 5)$ e) $3x - 5(2x + 6)$ f) $- 9 - (3x - 5)$

2 Expand and simplify

a) $(x + 4)(x + 8)$ b) $(3f + 9)(f - 7)$ c) $(2x + 6)(5x + 7)$

d) $(y + 6)^2$ e) $(4x - 5)^2$ f) $(2x - 3)(3x - 4) - 5x$

g) $(x + 2)(x^2 - 4x + 1)$ h) $(4x + 5)(3x^2 - 2x -7)$

3 Factorise the following expressions

a) $15m + 35$ b) $44k - 77$ c) $27y - 18$

d) $x^2 - y^2$ e) $4y^2 - 1$ f) $144 - 121x^2$

g) $81m^2 - 25n^2$ h) $3d^2 - 75$ i) $12k^2 - 27m^2$

4 Factorise the following expressions

a) $x^2 + 8x + 12$ b) $t^2 - 4t + 4$ c) $w^2 - 3w - 10$

d) $3m^2 + 7m + 2$ e) $2p^2 - 12p + 5$ f) $5y^2 + 8y - 4$

5 Solve the following equations

a) $4(x + 3) = 12$ b) $11 (p - 55) = 22$ c) $2n + 7(n + 2) = 4 - n$

Solving Linear Equation
Topic Homework 1.2b

1 Solve the following equations:

a) $2 + 2x = 10x - 14$

b) $13x + 11 = 2(10x - 19)$

c) $2(2x + 5) = 8x - 50$

d) $10a + 13 = 20a - 387$

e) $7(2-d) = 2(d-12)$

f) $2(2y-1) - 8 = 10(1+y)$

g) $3(x^2 - 1) = x(3x - 6)$

h) $3(2-y) = 2(1+3y) - 7$

2 Solve these inequations:

a) $b + 3 \leq 10$

b) $7m \geq -28$

c) $10n + 15 \leq 45$

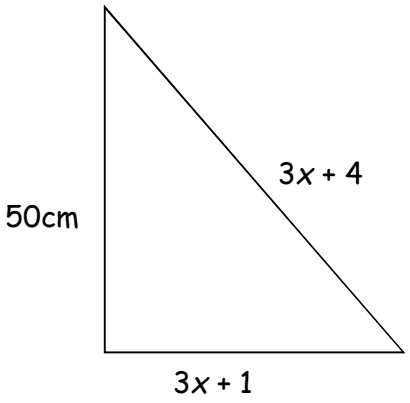
d) $4x + 5 > 2x + 17$

e) $4(3-4h) < 12 + h$

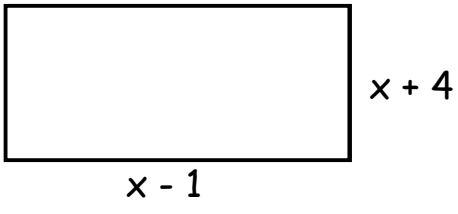
3 For the right angled triangle shown:

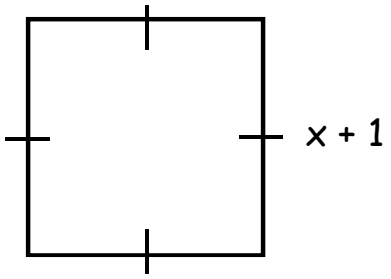
a) form an equation and solve for x

b) calculate the perimeter and area of the triangle.



4 This rectangle and square have equal areas. Make an equation and solve it to find the dimensions of each shape.





Change the Subject of the Formula
Topic Homework 1.2 (c)

1 Given that a = 5 and b = -3 calculate the following:

(a) $3ab$ (b) $2b - a$ (c) $\frac{6a}{b}$ (d) $4a^2$ (e) $(4a)^2$

2 In each of the following make (x), the subject of the formula

(a) $y = ax$ (b) $y = mx + c$ (c) $t = sx - r$

(d) $p = \frac{1}{2}x + 2$ (e) $m = 3(x - 3)$ (f) $a = \frac{3}{4}(8 - 2x)$

(g) $k = 3x^2$ (h) $a = \frac{x+8}{9}$ (i) $q = \sqrt{\frac{p}{k}}$

3 The cost of hiring a carpet cleaner, £C, is $C = f + 5h$ where f is the fixed cost and h is the number of hours hired.

Make h the subject of the formula.

4 The volume of a cylinder is given by the formula:

$V = \pi r^2 h$

(a) Change the subject of the formula to r.

(b) Calculate the radius of a 25 centimetre tall cylinder with a volume of $1\frac{1}{4}$ litres.

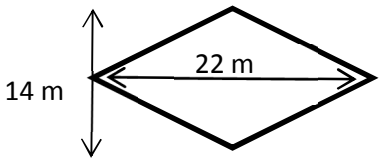
5 Galileo discovered the formula $h = \frac{1}{2}gt^2$ that shows how far a body will fall under gravity if air resistance is ignored. h is the vertical distance travelled, g is the acceleration of gravity on the Earth's surface and t is the amount of time the body falls for.

What effect will doubling the time have on the vertical distance?

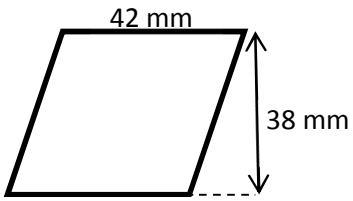
Area
Topic Homework 1.3a

1 Calculate the area of each shape:

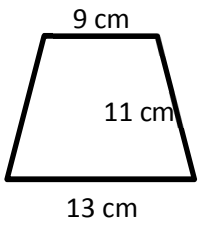
(a)

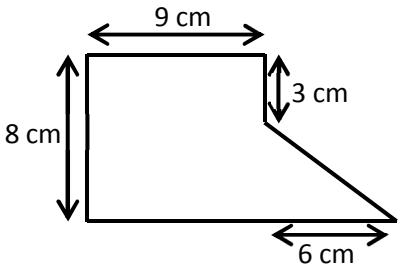


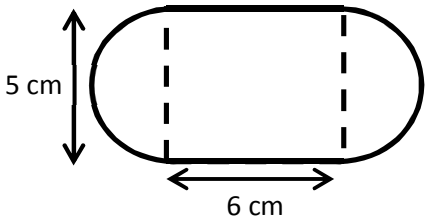
(b)



(c)

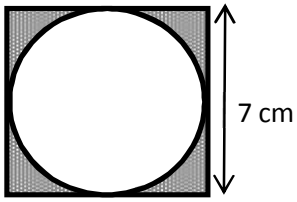




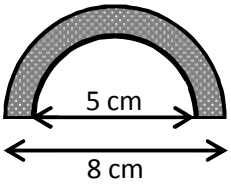


2 Calculate the shaded area:

(a)



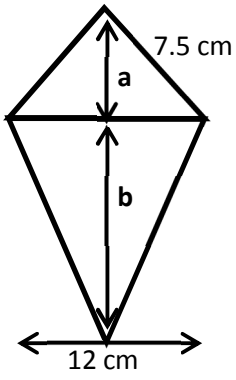
(b)



3 Mrs Kerr's class has painted a big mouse on the classroom wall.
It is made from a kite and two semicircles.
The diagonals of the kite are 125 cm and 80 cm.
The diameter of the semicircles is 50 cm.
Calculate the area of the mouse.

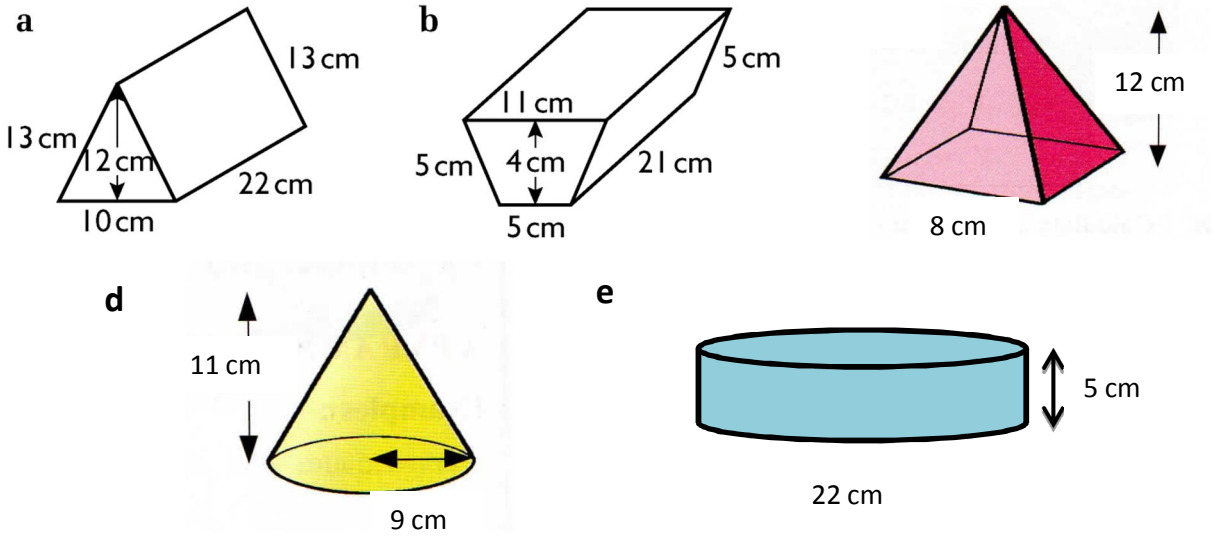
4 The blade of a bricklayers trowel is kite shaped.

a) Calculate the length of a.
b) The blade's perimeter is 46.2cm.
Calculate the length of b.
c) Work out the area of the trowel's blade.



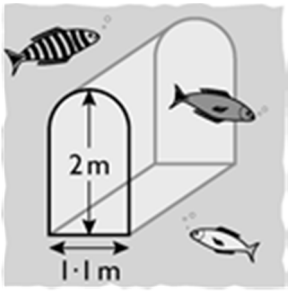
Volume
Topic Homework 1.3b

1 Calculate the volume of the following shapes:



2 An aquarium has a viewing tunnel which allows visitors to walk underneath the sea-life. The cross-section of the tunnel is a semicircle sitting on top of a rectangle. The tunnel is 7·4 m long.

Calculate its volume.

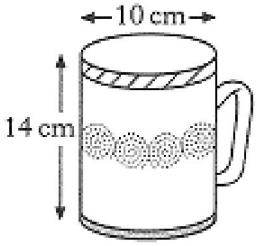


3 A mug is in the shape of a cylinder with a diameter of 10cm and a height of 14 cm.

a) Calculate the volume of the mug.

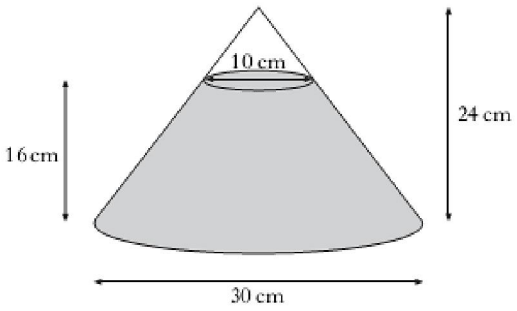
b) 600 ml of coffee are poured in.

Calculate the depth of coffee in the mug.



4 A glass ornament in the shape of a cone is partly filled with coloured water.
What is the volume of the water contained within the ornament?

(Give your answer correct to 2 significant figures

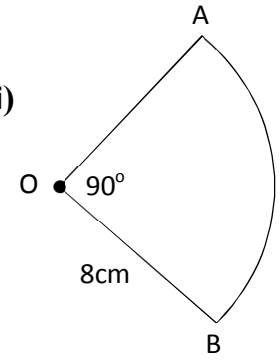


The Circle – Arcs & Sectors
Topic Homework 1.4a

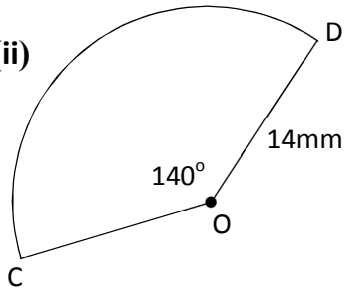
1. For each shape calculate:

   (a) The area of the sector (to 3s.f.)
   (b) The length of the arc (to 3s.f.)

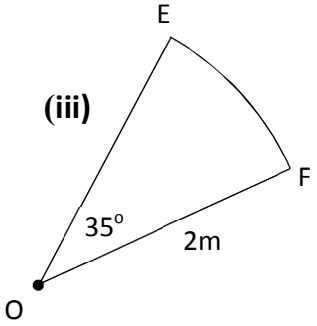
(i)



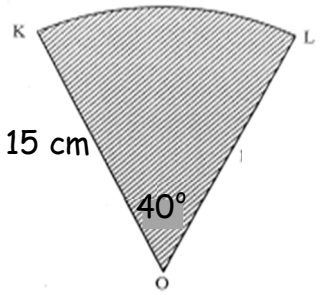
(ii)



(iii)

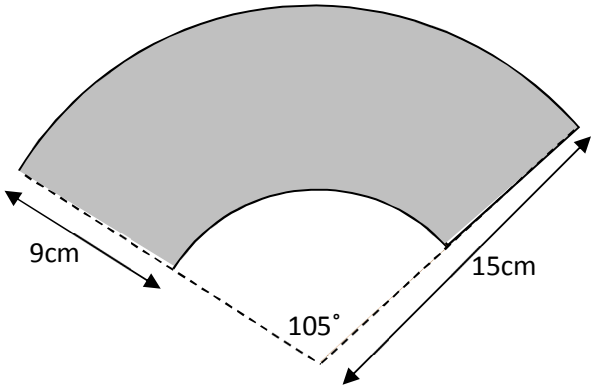


2. Sector KOL of a circle centre O and radius 15 centimetres is shown.



   a) Calculate the area of this sector.
   b) Calculate the length of the arc KL.

3. A hand fan is made of wooden slats with material on the outer edge.

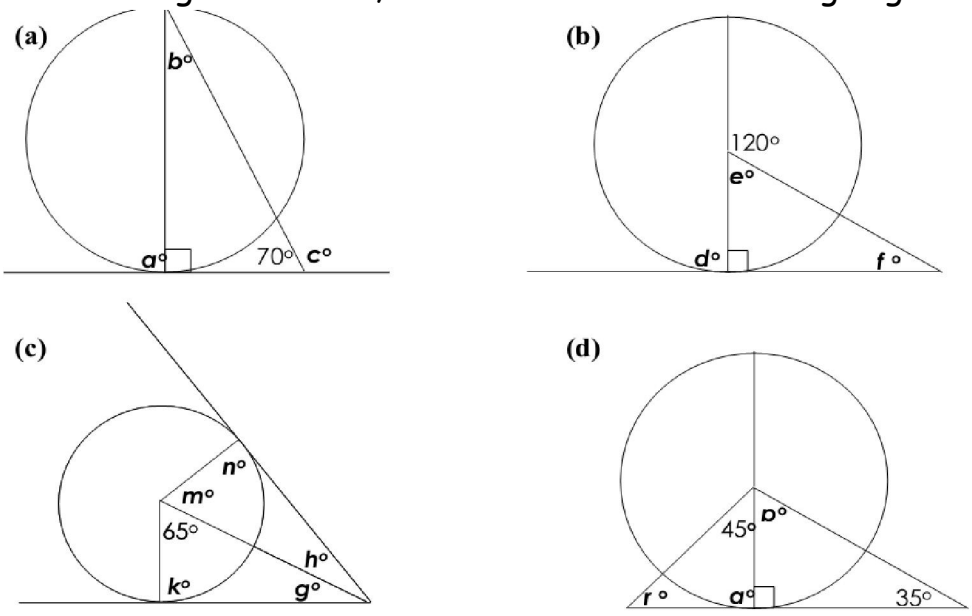


   a) Calculate the area of material needed for the hand fan.

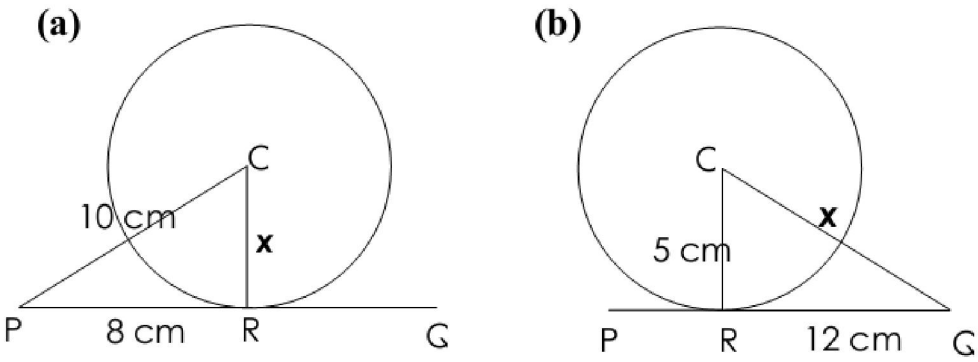
   b) Calculate the perimeter of the shaded area in the diagram above.

The Circle – Angles in Circles
Topic Homework 1.4b

1. In each of the diagrams below, find the size of the missing angles.

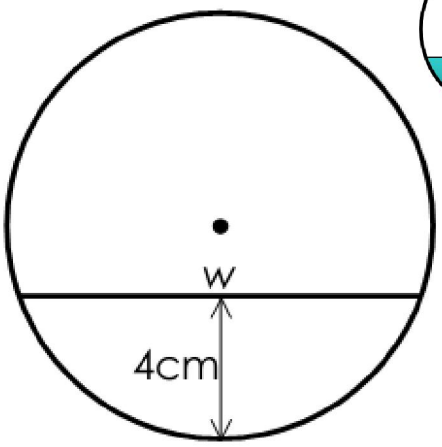


2. In each of the diagrams below, find the size of the length marked, x.



3. A child's toy is in the shape of a sphere with a duck and some water inside.

As the ball rolls around the water remains at the same level.
The diagram opposite shows the cross section when the sphere has been halved.



Given that the radius of the sphere is 6 cm and that the depth of the water is 4cm, calculate the width of the water surface

Statistics 1
Topic Homework 1.5

1 For the following data:
- i) make a 5-figure summary
- ii) construct a box-plot
- iii) calculate the semi-interquartile range

a) 12 8 7 19 23 25 20 14

b) 2 7 7 11 15 24 32 44 45 47 48

2 A box contains 5 red, 6 green, 7 blue and 2 yellow coloured pencils.
Jenny picks one out of the box

a) What is the probability that it is a green pencil ?

b) She does NOT replace the pencil, but draws another one.
What is the probability that this is a blue pencil?

3 A garage carried out a survey on 600 cars. The results are shown in the table below

Engine size cc

Age	0 – 1000	1001-1500	1501-2000	2001 +
Less than 3 years	50	80	160	20
3 years or more	60	100	120	10

a) What is the probability that a car chosen at random, is less than 3 years old?

b) In a sample of 4200 cars, how many would be expected to have an engine size greater than 2000cc **and** be 3 or more years old?

4. In a supermarket the manager noted the times, in minutes, that a sample of customers spent in the store first thing in the morning.The results are shown in the stem and leaf diagram below

1	4 6	
2	2 3 7	
3	3 3 3 4	
4	0 0 3	
5	0 1	n = 14 1 | 6 = 16

a) For the given data, find the median, the lower quartile and the upper quartile.

b) Construct a box-plot for the data.

Unit 1 Mixed Homework 1A

1. Solve the following equations

   a) $5x - 3 = 2x + 3$ b) $3(2y - 1) = 21$

2. Calculate the following

   a) $3 + 4 \times 6$ b) $(5 + 3) \times 6 - 4$ c) $7 - 2 \times -6$

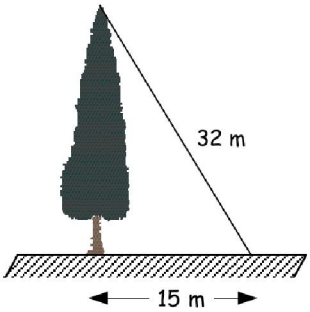
3. Rearrange to make x the subject of the formula:

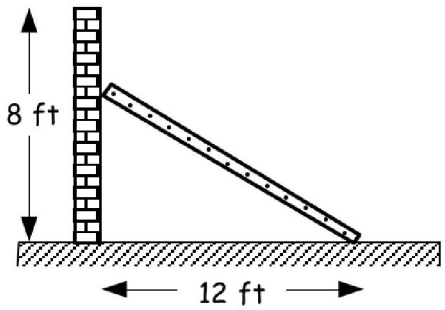
   a) $x - 4 = y$ b) $3x + 6 = 3w$ c) $\frac{1}{2} x = 2z$

4. Calculate:

   a) $\frac{3}{4}$ of 7650 kg b) 15% of £75 c) $1\frac{1}{2} + 2\frac{3}{4}$

5. Calculate the height of the tree.
   Give your answer correct to 1 d.p



6. 

The top of a ladder is placed **three quarters** of the way up an eight foot high wall.

Unit 1 Mixed Homework 1B

1 a) $2.5 - 1.83 + 4.12$ b) $2\frac{1}{2} \times 3\frac{3}{4}$ c) $72.3 \div 600$

2 Simplify the following fully:

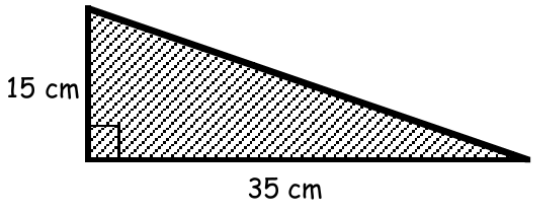
a) $5(x - 7) - 8x$ b) $(2x - 5)^2$ c) $(x + 3)(2x^2 - 4x - 5)$

3 Solve the following:

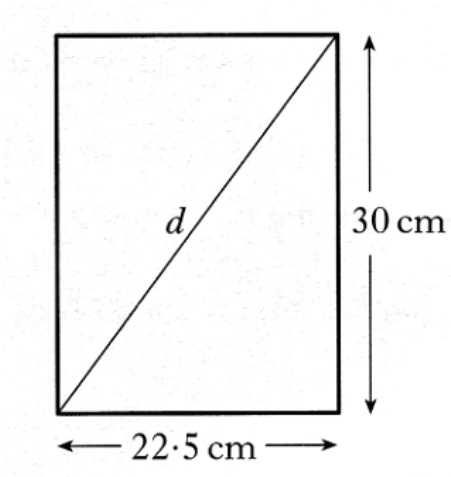
a) $7(4x - 6) = 4(5x - 12)$ b) $3 - (2x - 4) \geq 4x - 5$

4 A triangular car window frame needs a rubber seal around its perimeter.

Find the perimeter of window.



5



A rectangular picture frame is to be made.

It is 22.5 cm wide and 30cm tall, as shown.

To check the frame is rectangular, the diagonal, d, is measured. It is 37.3 cm long.

Unit 1 Mixed Homework 3C

1 a) $8.1 - 19.4 \div 4$ b) $5\frac{1}{2} \div 1\frac{3}{8}$ c) 42% of £650

2 Expand and simplify fully:

a) $5 + 2(x - 3)$ b) $8x - 3(x - 2)$ c) $(y + 1)(y + 2)$

d) $(2x - 3)(x + 4)$ e) $(3x - 5)(4x - 3)$ f) $(3x - 1)^2$

3 Factorise fully:

a) $15x - 35y$ b) $27a + 45a^2$ c) $x^2 - 16$

d) $w^2 - 1$ e) $100g^2 - 49b^2$ f) $5p^2 - 45$

g) $t^2 + 4t + 4$ h) $b^2 + 7b - 30$ i) $6g^2 + 7g + 2$

4 Solve the following:

a) $5 - 3x = x + 1$ b) $-6 = 2(y - 3)$

c) $20 - 3(x + 2) = 8$ d) $5(y + 2) + 10 = 0$

e) $2(y + 3) - 3y = 6$ f) $(k + 2) - 5(k + 1) = k + 4$

g) $10 \geq 5(8 - 2w)$ h) $5 - (r + 1) \leq -1$

Unit 1 Mixed Homework 1D

1 b) 40% of £18.60 -3.25 b) $2\frac{3}{5} - 1\frac{1}{2} \times \frac{3}{4}$ c) 6.24 ÷ 500

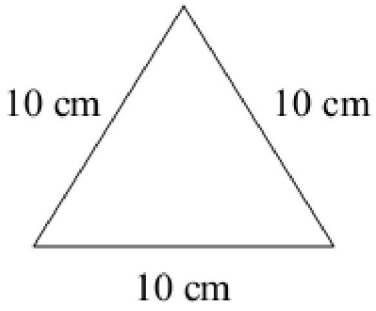
2 Factorise the following:

a) $5xy - 7yz$ b) $12g^2 - 2g$ c) $36 - x^2$

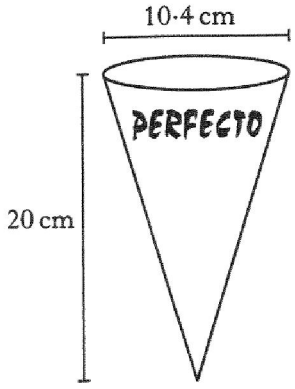
d) $x^2 - 5 + 6$ e) $6y^2 - 7x - 3$ e) $4x^2 - 6x + 2$

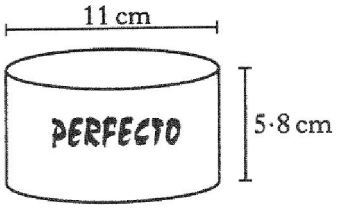
3 (a) Find the length of the altitude of the equilateral triangle sketched below.

(b) Find the area of the triangle.



4 Perfecto ice cream is sold in cones and cylindrical tubs with measurements as shown below.





Both the cone and tub of icecream cost the same.
Which container is the best value for money?
Give a reason for your answer.

Unit 1 Mixed Homework 1E

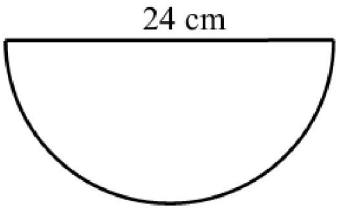
1 Factorise fully:

a) $3a^2 - 12$ b) $2b^2 + 5b + 3$ c) $6c^2 - 13c + 6$ d) $2d^2 + d - 1$

2 Without a calculator, evaluate

(a) $2\frac{1}{2}+3\frac{3}{5}$ (b) $2\frac{2}{3}\times1\frac{7}{8}$ (c) $5\frac{1}{3}\div2\frac{2}{3}$

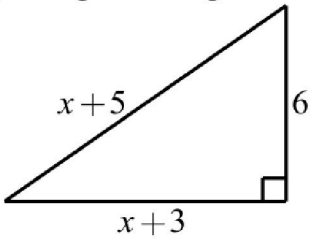
3 This semicircle has diameter 24 cm.



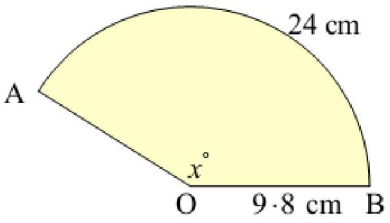
(a) Calculate the perimeter of the shape.

(b) Calculate the area of the shape.

4 Find the value of x in the right-angled triangle sketched below.



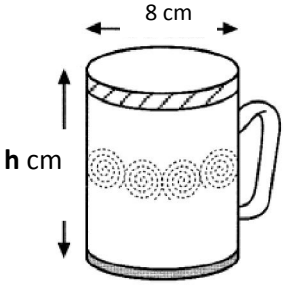
5 The length of the arc AB in the diagram shown, is 24 cm.Find the size of the angle AOB



6 A mug is in the shape of a cylinder with diameter 8 cm.

When full the mug holds a total of 700ml.

Calculate the height of the mug, to the nearest cm.



Unit 1 Mixed Homework 1F

1. Multiply out the brackets and simplify:
   a) $(x - 6)(x + 1)$ b) $(x + 7)(3x^2 + 9x - 2)$ c) $4(x - 3) + (x + 3)^2$

2. For each of the data sets below:
   a) make a five-figure summary b) construct a box plot

   i) 2 4 5 6 7 8 10 14 18

   ii) 149 165 154 167 170 179 151 168 158

3. Find the semi-interquartile range for the data sets in question 2.

4. A bag contains **red**, **green**, **blue**, **yellow**, and **white** balls. There are 10 of each colour, numbered from 1 to 10. The balls are placed in a drum and one is drawn out.

   a) What is the probability that it is a **9**?
   b) What is the probability that it is a **green 9**?

5. The National Tourist Association carried out a survey amongst 500 adults from the UK to find out what would influence them most when choosing a holiday. The results of the survey are shown in the table below.

Age	Price	Weather	Facilities	Scenery
35 and under	190	65	23	7
Over 35	95	35	12	73

   a) What is the probability that any adult chosen at random would have scenery as their main priority when choosing a holiday ?

   b) A 25 year old adult is chosen at random. What is the probability that the facilities is his/her main concern when choosing a holiday ?

   c) What is the probability that any adult chosen at random **will not** have cost as their main concern when choosing a holiday ?

Percentages
Topic Homework 2.1

1 Calculate the compound interest (to the nearest penny) on:

(a) £3000 for 5 years at 5% per annum.

(b) £400 for 3 years at 7% per annum.

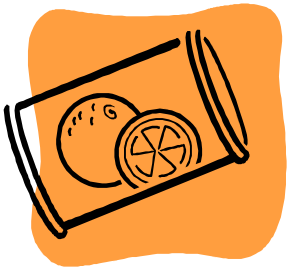
(c) £45000 for 4 years at 4.25% per annum.

2 In the year 2010 it was estimated the Amazon rain forest was home to 60 000 poison arrow frogs. Due to loss of habitat the number of frogs is falling at a rate of 15% per annum. Calculated the estimate number of frogs there will be in 2014.

3 A raincloud contains 2500 litres of water. The cloud is increasing in size at a rate of 4.3% per hour. Calculate the volume of water in the cloud in 8 hours time.

4 A One Direction concert is attended by 6400 people on a Friday evening. That evening 80% of the tickets had been sold. How many people can the venue hold when full?

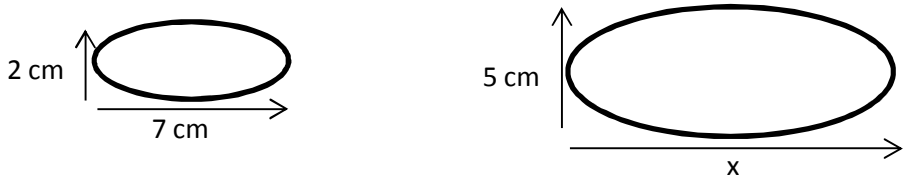
5 A can of Fanta contains 396 millilitres. This is 20% more than a normal sized can. How much does a normal can of Fanta hold?



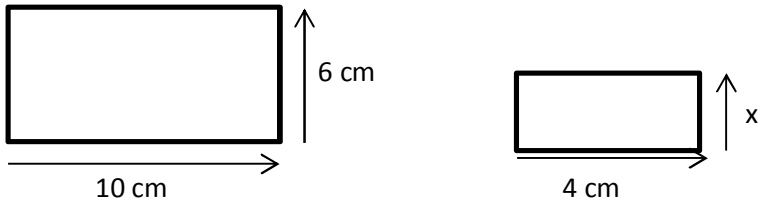
Similar Shapes
Topic Homework 2.2

1. The following shapes are mathematically similar. Find the length of side x.

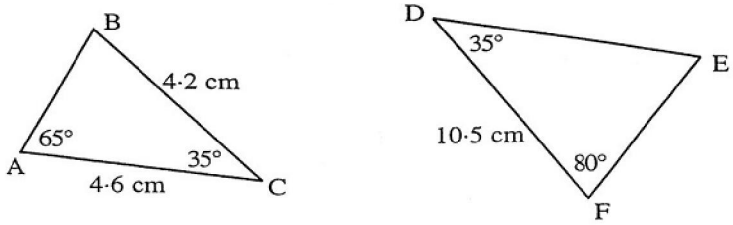
a)



b)



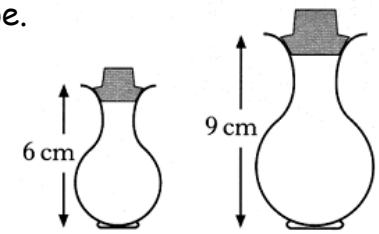
2. Study the two triangles shown.



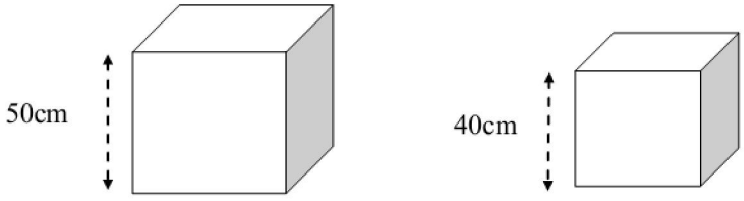
a) Explain clearly why the two triangles must be similar.

b) Use the fact that the two triangles are similar to calculate the length of the line DE.

3. Two perfume bottles are mathematically similar in shape.
The smaller one is 6 centimetres high and holds 30 ml of perfume.
The larger one is 9 cm high.
What **volume** of perfume will the larger one hold?



4. The two boxes below are mathematically similar and both have to be wrapped with decorative paper.



If it requires 3.27 m^2 of paper to cover the large box, calculate the **area** of paper needed to cover the smaller box.

The Straight Line
Topic Homework 2.3

1. Calculate the gradients of the lines joining the following points:

   (a) A(2, 3) and B(7, 9) (b) C(-3, 5) and D(7, 0)

2. (a) Find the gradient and y-intercept for these straight lines:
   (i) $6y - 3x = 7$ (ii) $9 - 4x + y = 0$ (iii) $5 = 2x - 8y$

   (b) Write down the equation of a line parallel to $2x + y = 6$, passing through:
   (i) (5, 6) (ii) (0, 3)

3. Use the equation $y - b = m(x - a)$ to find the equation of the line through the given point, with the given gradient.

   (a) (4, 6), m = 2 (b) (3, -1), $m = -\frac{2}{5}$

4. Find the equation of the line connecting the points:

   (a) (3, 3) and (4, 6) (b) (-2, -5) and (-3, 7) (c) (0, 5) and (-4, -5)

5. During Sports Day data from the competitors doing high Jump and long jump were compared.

Long Jump	3.61	3.96	4.13	3.75	4.91	4.65	3.87
High Jump	1.26	1.52	1.43	1.32	1.63	1.59	1.53

   (a) Plot a scatter diagram and plot a line of best fit.

   (b) Calculate the gradient of the line of best fit.

   (c) Use your line to estimate the height of someone's jump if their long jump length is 4.5 m.

Simultaneous Equations
Topic Homework 2.4

1. Solve these pairs of simultaneous equations **graphically**.

   a) $2x + y = 6$
      $x - 2y = 8$

   b) $x + y = 8$
      $2x + y = 4$

2. a) 4 peaches and 3 grapefruit cost £1.30
   Write down an algebraic equation to illustrate this.

   b) 2 peaches and 4 grapefruit cost £1.20.
   Write down an algebraic equation to illustrate this.

   c) Find the cost of 3 peaches and 2 grapefruit.

3. David and Joanna each book in at the Sleepwell Lodge.

   a) David stays for 3 nights and has breakfast on 2 mornings.
   His bill is £145
   Write down an algebraic equation to illustrate this.

   b) Joanna stays for 5 nights and has breakfast on 3 mornings.
   Her bill is £240.
   Write down an equation to illustrate this.

   c) Find the cost of one breakfast.

4. On a camping holiday a group of 30 students take 3 frame tents and 2 ridge tents.

   Another group of 25 students take 2 frame tents and 3 ridge tents.

   How many people does each type of tent hold ?

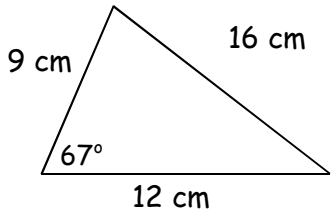
5. 3 pounds of butter and 4 pints of milk costs £3.84.
   5 pounds of butter and 7 pints of milk costs £6.48.

   Find the cost of a pound of butter and a single pint of milk.

Trigonometry
Topic Homework 2.5a

1. A piece of plastic was cut in the shape of a triangle.

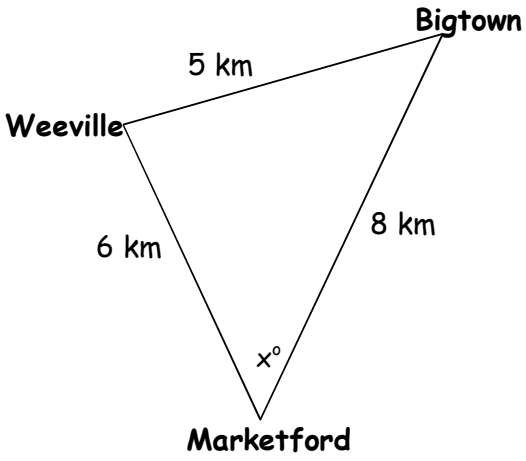
Calculate the area of this piece of plastic.

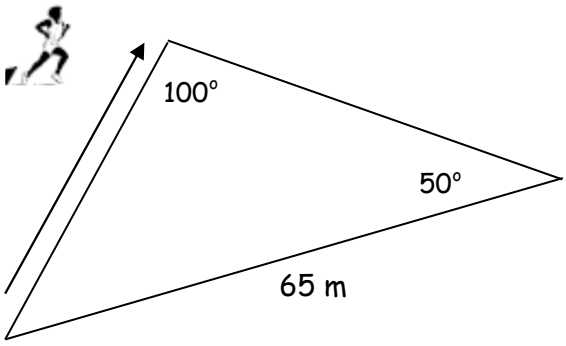


2. A cargo ship leaves Bigtown.

It travels 5 km to Weeville and then 6 km to Marketford delivering goods.

The ship then returns to Bigtown, a distance of 8 km.



3. 

The diagram shows a triangular shaped park. A jogger runs along one side of it as indicated.

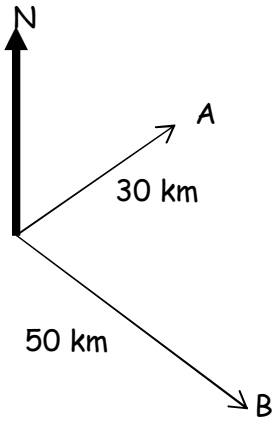
Calculate how far he has jogged.

4. Two yachts leave harbour H.

Yacht A sails on a bearing of 045° for 30 km then stops.

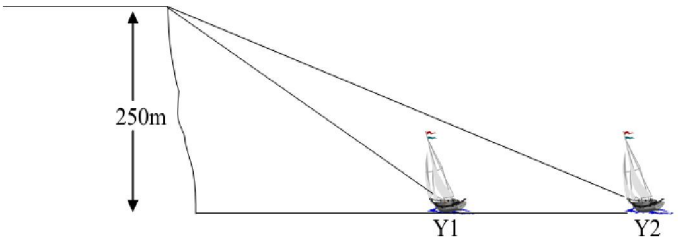
Yacht B sails on a bearing of 155° for 50 km the stops.

How far apart are the two yachts when they have both



Trigonometry (2)
Topic Homework 2.5b

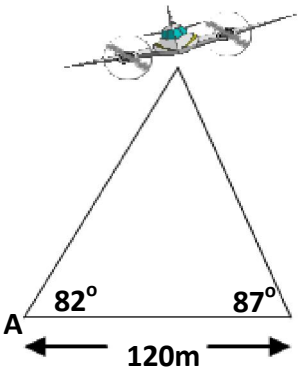
1. From a point 250m above sea-level, a coastguard measures the angles of depression of two yachts due east of him as 16° and 28°



(a) Calculate the distance of each yacht from the base of the cliff.
(b) Calculate the distance between the yachts.

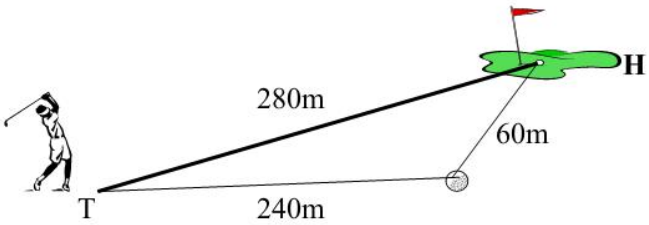
2. Two spotlights 120m apart on either side of a runway pick up an aircraft coming in to land.

Find the distance from the aircraft to spotlight A.



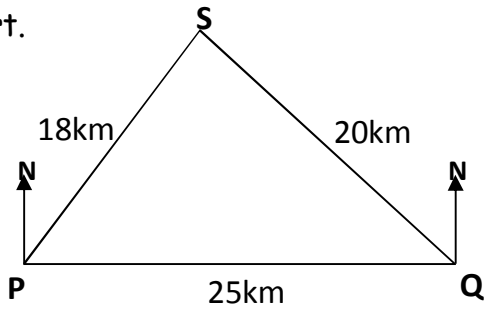
3. A golf ball at T is 280m from the hole H.

The ball is struck and comes to rest 240m from the tee.



After walking to the ball the golfer finds that the ball is still 60m from the hole. Calculate the angle between the line TH and the direction of the golfer's shot from T.

4. Two coastguard stations, P and Q, are 25 km apart. Q is due East of P.
A ship, S, is at a distance of 18 km from P and 20 km from Q.



a) Calculate the size of angle SPQ.
b) Hence calculate the bearing of the ship S from station P.

Standard Deviation
Topic Homework 2.6

$$s = \sqrt{\left(\frac{\Sigma(x-\bar{x})^2}{n-1}\right)}$$

1. Find the standard mean and standard deviation of the following:

   a) 19 21 23 21 19 20

   b) 63 71 68 59 69 75 57

2. The Mobile Phone Shop is advertising their five latest mobile phones on their website.
   Their prices are:

   £120 £135 £75 £235 £185

   Calculate the mean and standard deviation of these prices.
   (Show all working)

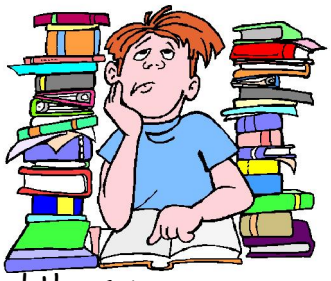
3. Fiona checks out the price of a litre of milk in several shops.
   The prices in pence are:

   49 44 41 52 47 43

   a) Find the mean price of a litre of milk.
   b) Find the standard deviation of the prices.
   c) Fiona also checks out the price of a kilogram of sugar in the same shops and finds that the standard deviation of the prices is 2.6.
   Make one valid comparison between the two sets of prices.

4. A group of fourth year students from Auchinleck Academy were asked how many hours studying they did in the week prior to their exams.
   The results are shown below.

   14 7 9 12 19 10 16 15



   a) Calculate the mean and standard deviation of these times.

   b) A similar group of students from Cumnock Academy were asked the same question. The mean number of hours studied was 16 and the standard deviation was 2.2.
   How did the number of hours studied by students from Auchinleck compare with that of Cumnock Academy.

Unit 2 Mixed Homework 2A

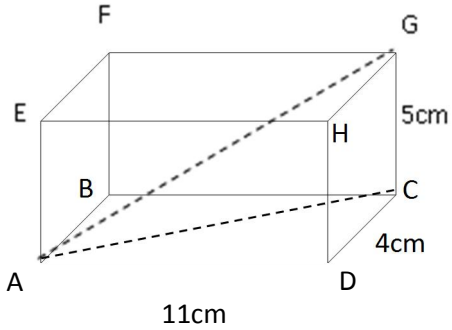
1. Solve the following equations:

(a) $3(x+1)+2(x+3)=19$ (b) $4x-(x-1)=19-3x$

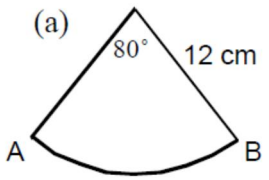
2. A rectangle has length $2\frac{5}{7}$ cm and breadth $1\frac{2}{5}$ cm. Calculate its perimeter

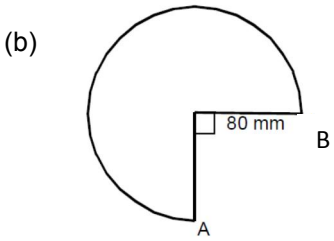
3. In 2010 the Portable Phone Company announced that their profits were £950 000. In the next 4 years their profits increased by 4·2% each year. How much profit did the company make in 2014?
Give your answer to the nearest thousand.

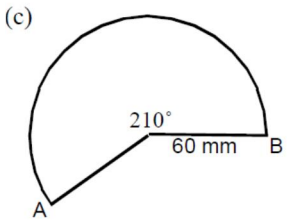
4. Answer the following about the cuboid opposite.
   a) Calculate the length of the face diagonal AC.
   b) Hence calculate the length of the space diagonal AG.



5. Calculate the length of arc AB and the area of each sector of each of these circles:







6. Joe buys a car for £8000. 3 years later he sells the car for £5200. Calculate the percentage depreciation of the car, correct to 3 significant figures.

7. Mrs Kerr buys a new handbag which cost £48 after being reduced by 20% in a sale. Find the original cost of the handbag, before the price was reduced.

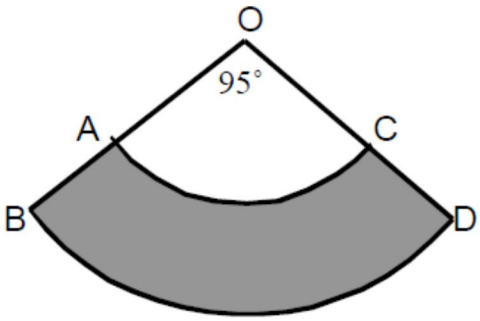
Unit 2 Mixed Homework 2B

1. a) Find 3.5% of £9860 b) $3\frac{1}{4}+(2\frac{1}{5}\text{ of }\frac{5}{6})$ c) $\frac{4}{13}\div(1\frac{3}{11}\text{ of }6\frac{2}{7})$

2. In the diagram below, AC and BD are arcs of circles with centres at O.

   The radius, OA, is 10 centimetres and the radius OB, is 16 centimetres.

   Find the shaded area.

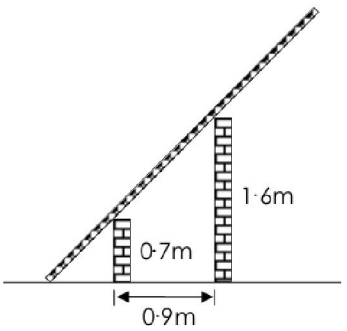


3. Layne and Taylor go to the fairground.
   A stall has a card game where a goldfish can be won if anyone can turn over a face card from a pack of 52 cards which are placed face down.
   Calculate the probability, in its simplest form, of Taylor winning the goldfish.

4. A journey of 240 km is made in the following way:
   The first 30 km at an average speed of 60 km/hr.
   The last 50 km at an average speed of 50 km/hr.
   The middle part of the journey at an average speed of 80 km/hr.
   Find the time taken for the whole journey.

5. Luke weighs 102kg. On the 1st of April, he starts a diet which is designed to reduce his weight by 8% per month.
   Luke goes on holiday on the 1st of July and has set himself a target weight of 85kg. Will Luke achieve his holiday target?

6. In the diagram a ladder is laid against two walls as shown.
   The higher wall is 6·1 m high, and the lower wall is 7.0m.
   The distance between the two left hand faces of the walls is 9.0 m.
   Calculate the distance between the foot of the ladder and the lower wall.



Unit 2 Mixed Homework 2C

1. Factorise:
   a) $4y^2 - 49z^2$ b) $2 - 50g^2$ c) $8x^2 - 10x - 3$

2. Make (x) the subject of the fomula:
   a) $3(x - 5) = 6y$ b) $\frac{5a}{b} = 4c - 1$ c) $L = \frac{1}{2}(4a - t)$

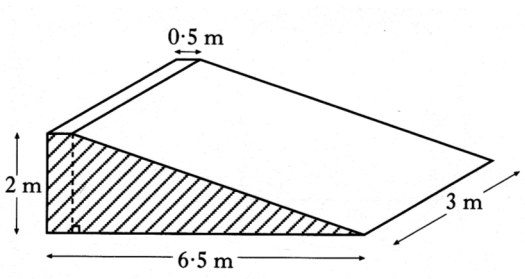
3. The area of a circle is 100 square centimetres. Find its radius, to 3 significant figures.

4. Sean invested £15 000 in the Dodgy Building Society but his money lost 5% per annum over the first 2 years.

   At the end of this time he decided to move his money to the Goody Building Society which guaranteed that his money would gain 6% per annum over the next 2 years.

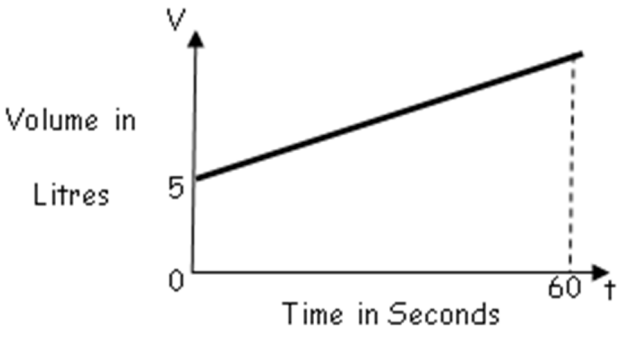
   How much did Sean gain or lose over the four years?

5. A ramp is being made from concrete. The uniform cross section of the ramp consists of a right angled triangle and a rectangle as shaded in the diagram.

   Find the volume of concrete required to make the ramp.

6. The tank of a car contains 5 litres of petrol. The graph below shows how the volume of petrol in this tank changes as a further 45 litres of petrol is pumped in at a steady rate for 60 seconds.

   Find the equation of the straight line in terms of V and t.

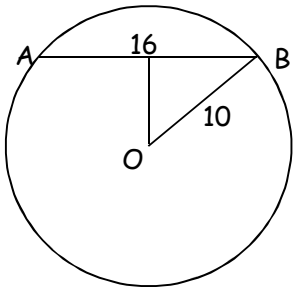
Unit 2 Mixed Homework 2D

1. A restaurant manager finds that the cost of running his restaurant depends on the number of meals served.

Number of meals	10	20	30	40	50	60
Cost in £	188	192	220	216	232	248

a) Plot the points and draw the best fitting straight line through them.
b) Find the equation of the line.
c) Use your equation to estimate the cost when 35 meals are served.

2. Calculate the distance from O to chord AB.



3. The number of seats in a theatre is 250 and all tickets, adult and child, are sold. If a is an adult ticket and c a child ticket, write down an equation connecting a and c.

Adult tickets cost £8 and child tickets cost £5 . The revenue taken was £1920 one evening. Write down another equation in a and c.

Solve these equations to find the number of adults and children attending the theatre that evening.

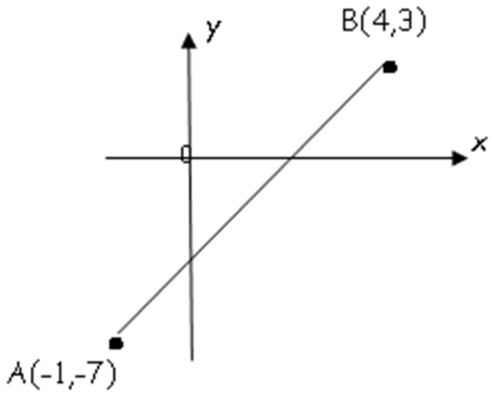
4. a) State the equation of the line that is parallel to $2x - 3y + 1 = 0$, passing through the point (0, 3)
b) Find the equation of the line connecting the points (5, 9) and (3, -1)

5. Expand and simplify fully:

a) $3x - 2(4x - 6) + 10$ b) $(2x + 1)(3x^2 - 4x + 5)$

Unit 2 Mixed Homework 2E

1. In the diagram, A is the point (-1, -7) and B is the point (4, 3).



   a) Find the gradient of the line AB.

   b) AB cuts the y-axis at the point (0, -5).
   Write down the equation of the line AB.

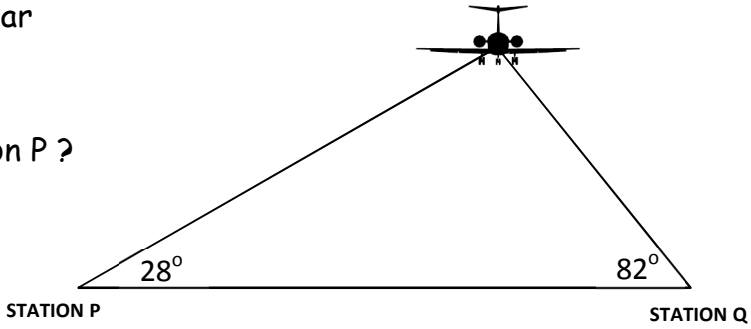
   c) The point $(3k, k)$ lies on AB
   Find the value of k.

2. The annual profit (£) of a company was 3.2×10^9 for the year 1997.
What profit did the company make per second?
Give your answer to **three significant figures**.

3. An antique was purchased for £850. It appreciated in value by 7.5% for two consecutive years. The following year it then depreciated in value by 8%. Calculate the value of the antique, 3 years after purchase.

4. An aircraft is picked up by two radar stations, P and Q, 120 km apart.

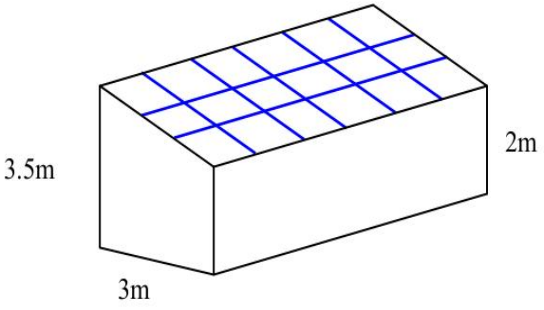
   How far is the aircraft from station P ?



5. The Scott family want to build a conservatory as shown.
The conservatory is to be 3 metres wide.

   The height of the conservatory at the lower end is to be 2 metres and at the higher end 3.5 metres.

   To obtain planning permission, the roof must slope at an angle of (25 + 2)° to the horizontal.



   Should planning permission be granted? ***Justify your answer.***

Unit 2 Mixed
Homework 2F

1. If $M = R^2t - 3$ Change the subject of the formula to R.

2. 4 books and 5 pens cost £26. Write down an equation to illustrate this information.

   5 books and 4 pens cost £28. Write down another equation to show this.
   Solve the equations to find out the cost of 3 books and 3 pens.

3. John measures how long he spends, in minutes, on phone calls each day for a week.
   The total for each day was as follows.

   4 2 8 3 1 2 1

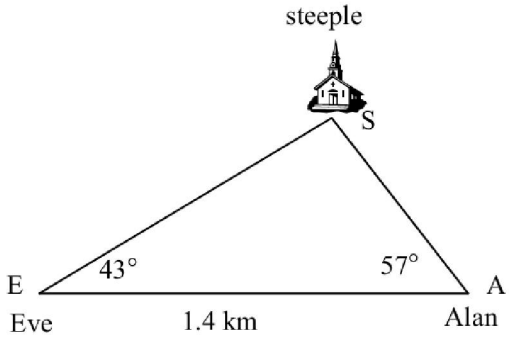
   Calculate the mean and standard deviation of his calls for the week.

   Karen measures her calls during the same week and finds that the mean length of her calls each day is 15.3 minutes with a standard deviation of 4.1. Comment on these results.

4. Find the equation of the line joining these pair of points.
   a) A (3,6) and B (5,8) b) G $(1,-2)$ and H $(0,-3)$

5. Eve and Alan are standing 1.4 kilometres apart. They both take a sighting on a steeple. Eve measures angle SEA as 43° and Alan measures angle SAE as 57°.

   a) Calculate the size of angle ESA.
   b) Calculate the distance Eve is from the steeple from the steeple.



Surds

Topic Homework 3.1a

1. Simplify the following:

   (a) $\sqrt{20}$ (b) $\sqrt{54}$ (c) $\sqrt{700}$ (d) $\sqrt{6400}$

   (e) $\sqrt{2} \times \sqrt{98}$ (f) $\sqrt{2} \times \sqrt{6}$ (g) $\frac{\sqrt{96}}{\sqrt{3}}$ (h) $\sqrt{\frac{8}{27}}$

2. Expand the brackets:

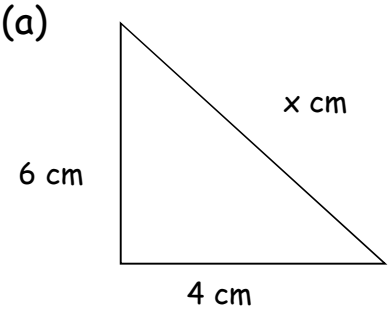
   (a) $(1 + \sqrt{3})(1 + \sqrt{3})$ (b) $(1 + \sqrt{5})(2 + \sqrt{5})$ (c) $\sqrt{2}(5 + \sqrt{8})$

3. Rationalise the denominator:

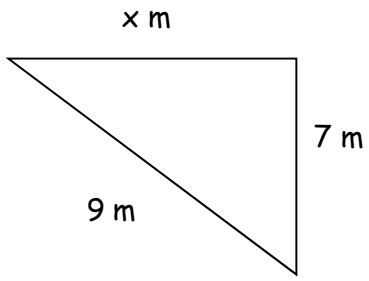
   (a) $\frac{3}{\sqrt{2}}$ (b) $\frac{5}{3\sqrt{7}}$ (c) $\frac{2}{3-\sqrt{5}}$ (d) $\frac{\sqrt{2}}{6+\sqrt{2}}$

4. Calculate the missing sides in each of the following triangles. Leave your answer in surd form.

   (a)



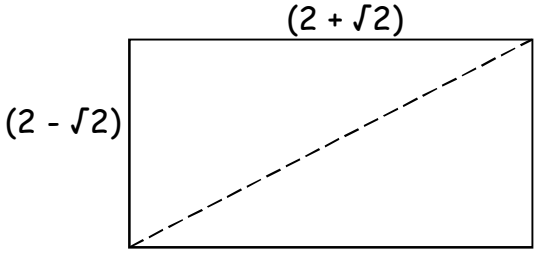
   (b)



5. A rectangle has sides measuring $(2 + \sqrt{2})$cm and $(2 - \sqrt{2})$ cm. Calculate the exact value of:

   a) The rectangles area

   b) The length of the diagonal.



Indices
Topic Homework 3.1b

1. Find the value of the following:

(a) 2^5 (b) 3^{-2} (c) $9^{\frac{1}{2}}$ (d) 3^{-3}

(e) 5^0 (f) $8^{\frac{2}{3}}$ (g) $9^{\frac{3}{2}}$ (h) 7^{-1}

2. Simplify each of the following:

(a) $a^4 \times a^{-3} \times a^{-1}$ (b) $\left(x^{\frac{1}{2}}\right)^6$ (c) $\dfrac{y^3 \times y^{-2}}{y^{-3}}$ (d) $\left(g^{-2}\right)^{-4}$

3. Simplify the following:

(a) $3t^3 \times 5t^4$ (b) $4m^6 \div 2m^2$ (c) $3y^2 \times 4y \times 5y$

(d) $\dfrac{k^2 \times k^4}{k^5}$ (e) $(f^3)^5$ (f) $(2c^{\frac{1}{2}}d^{\frac{1}{3}})^{-2}$

4. Express each of the following using positive indices:

(a) $6d^5 \times 3d^3$ (b) $\dfrac{q^3\, q^2}{q^{10}}$ (c) $\dfrac{7u^{\frac{1}{8}}}{6u^{\frac{9}{8}}}$ (d) $\dfrac{3j^4}{j^{\frac{1}{5}} \times j^{\frac{2}{5}}}$

5. The cost of hiring a carpet cleaner, £C, is $C = f + 5h$ where f is the fixed cost and h is the number of hours hired.
Make h the subject of the formula.

6. The volume of a cylinder is given by the formula: $V = \pi r^2 h$

(a) Change the subject of the formula to r.
(b) Calculate the radius of a 25 centimetre tall cylinder with a volume of $1\frac{1}{4}$ litres.

Algebraic Fractions
Topic Homework 3.1 c

1. Express each of the following in its simplest form:

a) $\frac{3}{a}+\frac{4}{2a}$ b) $\frac{7}{2p^2}-\frac{4}{3p}$ c) $\frac{5m}{6}\times\frac{3}{2m}$ d) $\frac{2c}{3}\div\frac{c^2}{6}$

2. Express as a single fraction in its simplest form: $\frac{3}{x}-\frac{2}{x-5}$.

3. Simplify these fractions

a) $\frac{4xy}{24y}$ b) $\frac{7tuv}{17t^2u}$ c) $\frac{3(p-2)}{(p-2)(p+5)}$ d) $\frac{6h+4}{15h+10}$

4. Calculate and simplify where possible

a) $\frac{5}{k}\times\frac{f}{4}$ b) $\frac{4b}{a^2}\times\frac{ab}{8}$ c) $\frac{d+3}{d}\times\frac{6}{d+3}$ d) $\frac{3}{2x}\div\frac{5}{3x}$

5. Simplify

a) $\frac{2}{x}+\frac{3}{y}$ b) $\frac{9}{2a}+\frac{2}{7a}$ c) $\frac{h}{3}-\frac{9}{h}$ d) $\frac{4f}{g^2}-\frac{g}{f^2}$

6. Solve the following equations:

(a) $\frac{x-2}{5}=3$ (b) $\frac{d-2}{3}-\frac{d-1}{4}=1$

7. Factorise then simplify:

(a) $\frac{x^2+3x+2}{x^2+6x+5}$ (b) $\frac{4x^2-9}{2x^2-x-3}$

Completing the Square
Topic Homework 3.2a

1. Express each of the following in the form $a(x + p)^2 + q$ by completing the square.

   (a) $x^2 + 10x + 27$ (b) $a^2 + 4a - 1$ (c) $c^2 - 2c + 5$

   (d) $x^2 - 14x - 15$ (e) $7 - 2w - w^2$ (f) $5 + 6q - q^2$

2. By expressing each of the following in the form $a(x + p)^2 + q$, write down its minimum value and the corresponding value of x.

   (a) $x^2 + 8x + 4$ (b) $x^2 - 4x + 6$ (c) $x^2 + 2x$ (d) $x^2 - 10x$

3. Express $x^2 + 2x + 7$ in the form $a(x + p)^2 + q$, and hence state the maximum value of $\frac{1}{x_2 + 2x + 7}$.

4. The height, h metres, of a golf ball in flight is given by $h = 55 + 10t - t^2$, where t seconds is the time of the flight.

   (a) Express h in the form $a(t + p)^2 + q$.

   (b) Find the maximum height of the ball, and the time taken to reach it.

5. The cost, c pence, of running a car for 100 miles at an average speed of x mph is given by:

$$c = \frac{1}{2}x^2 - 50x + 1750.$$

Calculate:

   (a) The most economical average speed.

   (b) The cost for 100 miles at this speed.

Quadratic Graphs & Equations
Topic Homework 3.1b

1 Solve these Quadratic Equations by Factorising:

b) $x^2 + 3x = 0$ b) $4y^2 - 10y = 0$ c) $12f^2 - 16f = 0$

2. Solve these Quadratic Equations by Factorising:

b) $y^2 - 16 = 0$ b) $81 - p^2 = 0$ c) $64g^2 - 4 = 0$ d) $a^2 - 121 = 0$

3. Solve these Quadratic Equations by Factorising:

b) $x^2 + 5x + 4 = 0$ b) $x^2 - 9x + 20 = 0$ c) $3x^2 - 12x + 12 = 0$

4. Solve these Quadratic Equations by Factorising:

a) $2x^2 - 8 = 0$ b) $12 - 75d^2 = 0$ c) $6x^2 - 6x - 36 = 0$

5. Write each expression in the form $(x + p)^2 + q$

a) $x^2 + 6x + 1$ b) $x^2 - 16x - 3$ c) $x^2 - 10x - 1$

6. Sketch the following, labelling key features:

a) $y = x^2 + 6x + 8$ b) $y = -15 = 8x - x^2$ c) $y = (x + 3)^2 - 2$

7. For each parabola (i) Find the equation of the axis of symmetry

(ii) state the nature of the turning point and its coordinates

a) $y = x^2 - 8x + 16$ b) $y = 7 + 6x - x^2$ c) $y = (x + 3)^2 - 2$

Quadratic Formula & Discriminant
Topic Homework 3.3

1. Solve these quadratic equations giving your answers to two decimal places.

   a) $x^2 + 11x + 1 = 0$ b) $x^2 - 5x + 2 = 0$ c) $5 = 3x(x+1)$

2. Solve the quadratic equation:

   $3x^2 + 10x - 7 = 0$ using an appropriate formula.

   Give your answer correct to 1 decimal place.

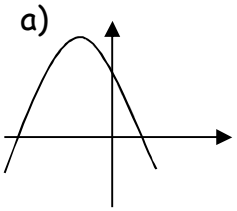
3. Use the discriminant to determine the nature of the roots of the equations

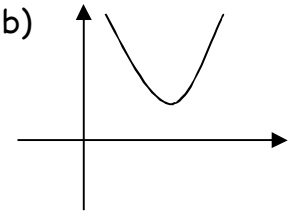
   b) $2x^2 - 6x + 5 = 0$ b) $3x^2 + 4x - 7 = 0$ c) $3x^2 - 5x - 4 = 0$

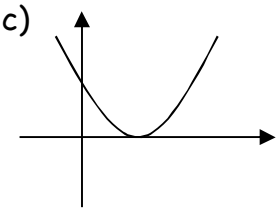
4. Find the value of p so that these equations have equal roots

   b) $2x^2 + 10x + p = 0$ b) $px^2 + 5x + 10 = 0$ c) $4x^2 - px + 1 = 0$

5. Here are some graphs of quadratic functions. What can you say about the discriminant for each one?

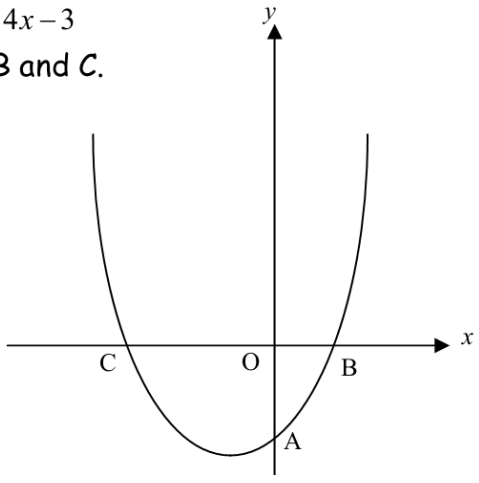
   a) 

   b) 

   c) 

6. The diagram shows part of the graph of $y = 4x^2 + 4x - 3$
   The graph cuts the *y*-axis at A and the *x*-axis at B and C.

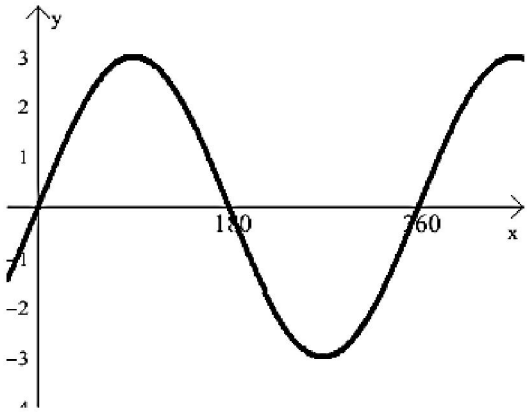
   a) Write down the coordinates of A.
   b) Find the coordinates of B and C.
   c) Calculate the minimum value of $y = 4x^2 + 4x - 3$



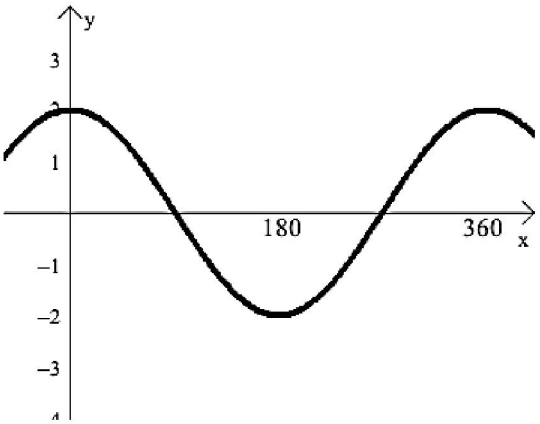
Trigonometry Graphs
Topic Homework 3.4a

1. Each of the Graphs below has an equation in the form y = asin bx or y = acos bx.
State the equation of each graph.

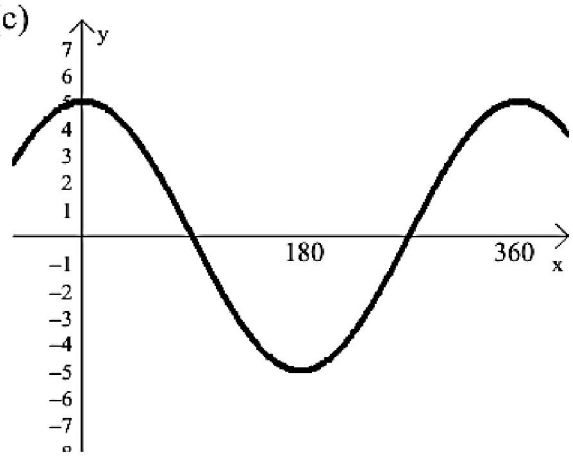
(a)



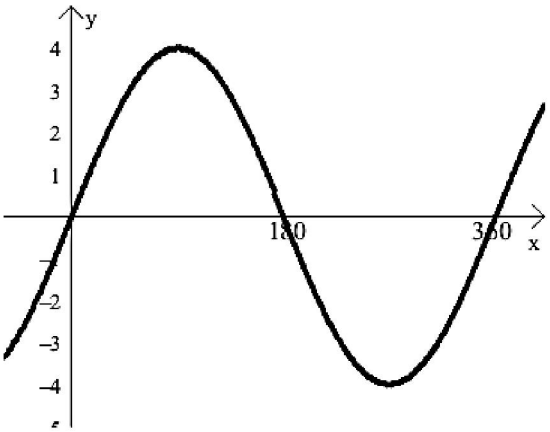
(b)



(c)

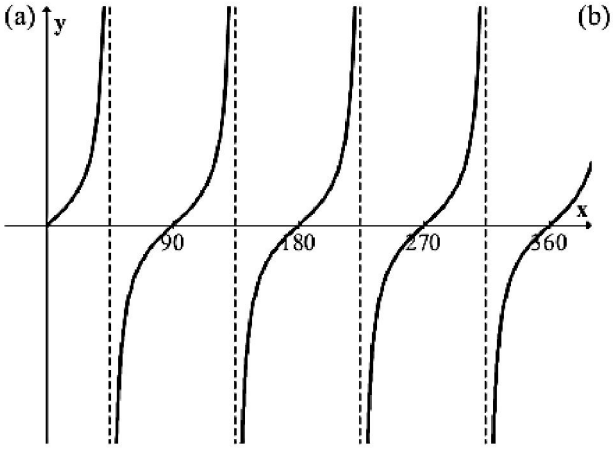


(d)

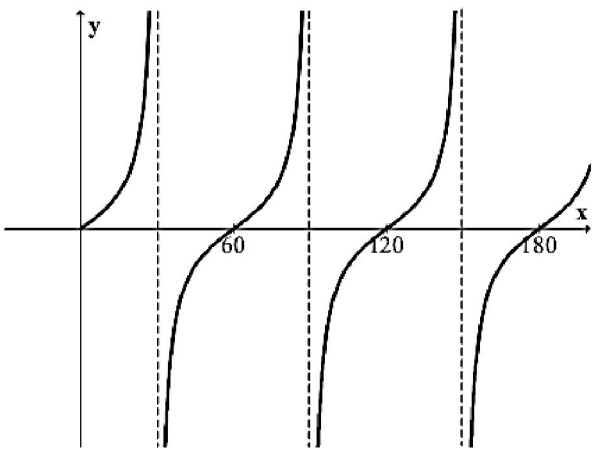


2. Each graph is in the form y = tan bx. Write down the value of b.

(a)

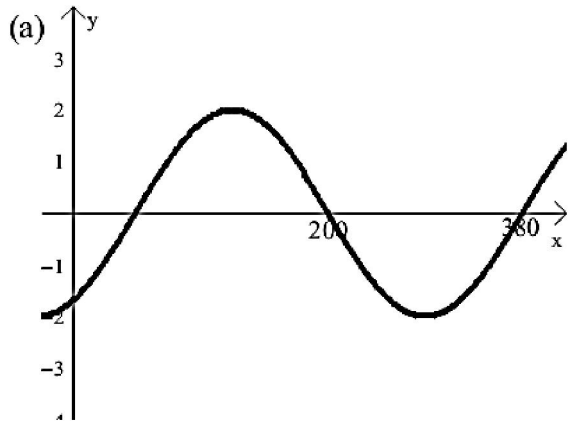


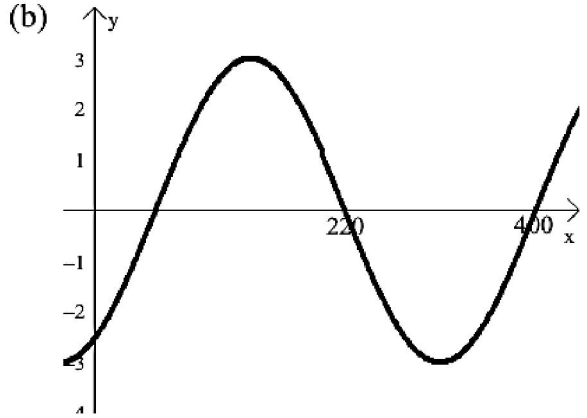
(b)



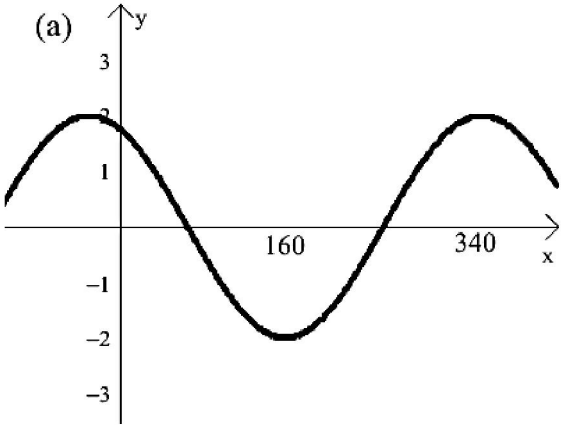
PTO →

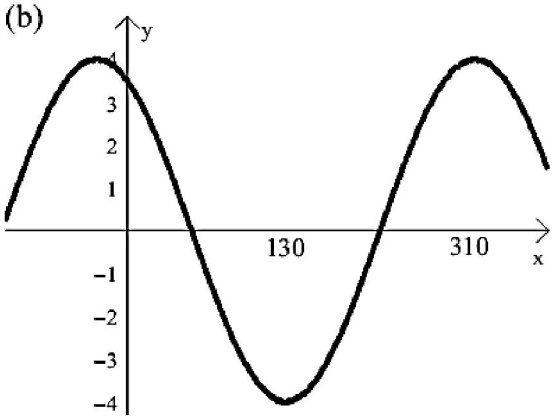
3. Each of the graphs below is in the form y = asin(x ± b). State the equation of each graph.





4. Each of the graphs below is in the form y = acos(x ± b). State the equation of each graph.





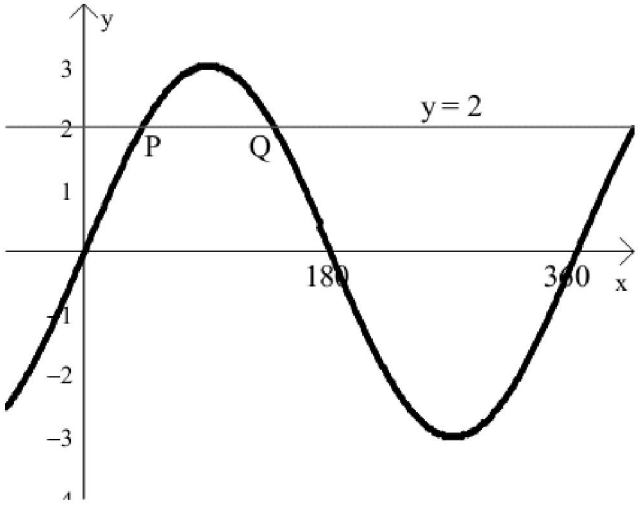
5. Make sketches of the following graphs for $0° \leq x° \leq 360°$

a) y = 6sin x b) y= 4cos x c) y =3sin 2x

d) y = 2.5cos 3x e) y = 4cos(x - 45) f) y = 3sin(x + 60)

6. (a) Write down the equation of the graph opposite in the form y = asin x.

(b) The line y = 2 meets this graph at the points P and Q. Find the coordinates of P and Q.



Trigonometry Graphs & Equations
Topic Homework 3.4b

1. Solve these equations for $0 \leq x \leq 360$

   a) $3\cos x° + 4 = 5$ b) $2\sin x° - 1 = 0$ c) $8\tan x° + 3 = 0$

2. Solve these equations for $0 \leq x \leq 360$

   a) $\sin x° = \frac{\sqrt{3}}{2}$ b) $\sqrt{3}\tan x° = 1$ c) $2\cos x° + \sqrt{3} = 0$

3. The depth of water in a harbour is given by the formula $d(t) = 12 + 8\sin(30t)°$ where d(t) is the depth in metres and t is the number of hours after 6 am.

   a) What is the depth at (i) 10am (ii) 1pm?

   b) When is the first (i) high tide after 6 am (ii) low tide?

   c) What is the depth of water at (i) high tide (ii) low tide?

4. A piston moves up and down under water so that its depth, D metres is given by $D(n) = 2 - 2\cos 30n°$, with n the time in hundredths of a second.

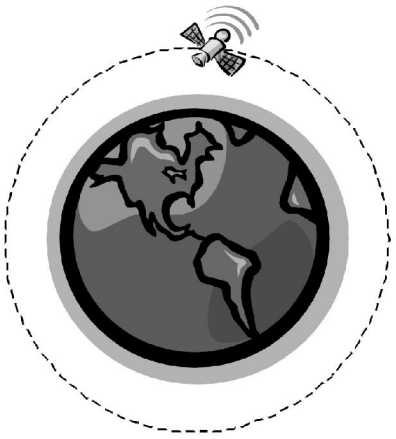
   a) How deep is the piston after (i) $\frac{5}{100}$ of a second (ii) $\frac{1}{10}$ of a second?

   b) How deep does the piston go? When does it reach this depth for the first time?

5. A satellite is programmed to orbit the Earth. The height of the satellite above the Earth, in kilometres, is given by the formula

$$H = 120 + 25\sin(40t)^0$$

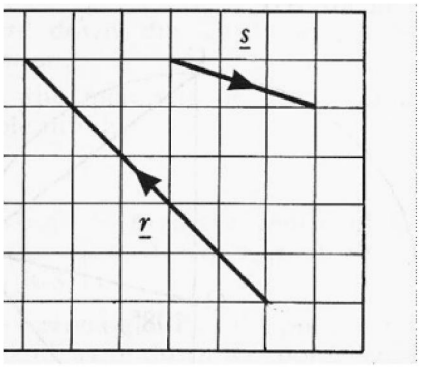
where t is the number of hours after midnight.



(a) What is the greatest distance from the Earth that the satellite will reach?
(b) Calculate the height of the satellite at 10.30 p.m.
(c) How many minutes after midnight will the satellite first be at a height of 132.5 kilometres?

Vectors
Topic Homework 3.5

1. (a) The diagram below shows representatives of the vectors **r** and **s**.



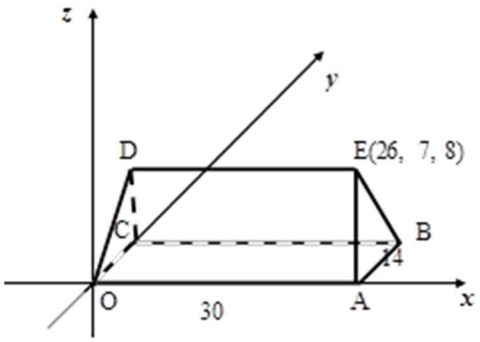
Write down the components of

(i) (1) **r** (2) **s** (3) **r** + **s**

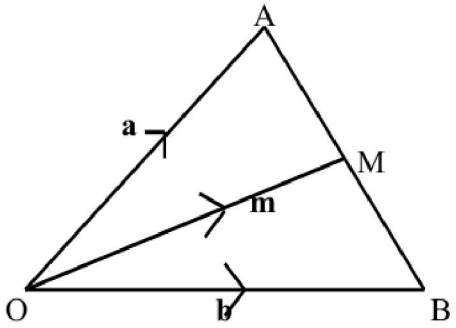
(ii) Express $|\mathbf{r}|$ as a surd in its simplest form.

2. This shape is made up from 2 congruent trapezia and 2 congruent isosceles triangles.

From the information given in the diagram, write down the coordinates of each corner of the shape.



3. Relative to an origin O, M is the mid-point of the line segment AB.
Vectors **a**, **b** and **m** represent the directed line segments $\overrightarrow{OA}$, $\overrightarrow{OB}$ and $\overrightarrow{OM}$ respectively.



(a) Show that $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$

(b) Show that $\overrightarrow{OM} = \frac{1}{2}\mathbf{a} + \mathbf{b}$

Trig Identities
Topic Homework 3.6

1. Simplify

(a) $3\cos^2 x + 3\sin^2 x$ **(b)** $1 - \cos^2 x$ **(c)** $\cos A \tan A$

(d) $5 - 5\sin^2 B^o$ **(e)** $\dfrac{4\sin a^o}{4\cos a^o}$ **(f)** $\dfrac{4\tan x^o}{2\cos x^o}$

2. Prove that

(a) $3\cos^2 a + 3\sin^2 a = 3$

(b) $(\cos x + \sin x)^2 = 1 + 2\sin x \cos x$

(c) $(\cos x + \sin x)(\cos x - \sin x) = 2\cos^2 x - 1$

(d) $\dfrac{\sin x}{\cos x} + \dfrac{\cos x}{\sin x} = \dfrac{1}{\cos x \sin x}$

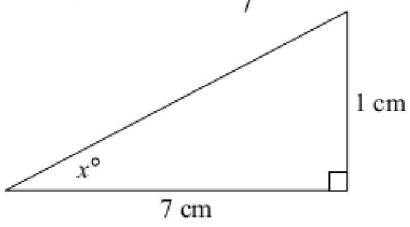
3. Simplify

$$\frac{1-\cos^2 x}{\cos^2 x}$$

4. Solve the equation, correct to 1 decimal place for $0 \le x < 360$.

$$2\sin x^\circ + 1 = \cos 60^\circ$$

5. In the right angled triangle, $\tan x^\circ = \dfrac{1}{7}$



a) Calculate the length of the hypotenuse leaving your answer as a surd.

b) Hence, write down as a surd: (i) $\sin x^\circ$ (ii) $\cos x^\circ$

c) If $\sin 2x^\circ = 2\sin x^\circ \cos x^\circ$,
find the exact value of $\sin 2x^\circ$.

Unit 3 Mixed Homework 1

1. Simplify the following fully:

b) $\sqrt{200}$ b) $\sqrt{75}$ c) $5\sqrt{32}$ d) $6\sqrt{40}$

e) $\sqrt{48} - \sqrt{12}$ f) $\sqrt{50} + \sqrt{18}$ g) $5(\sqrt{5} - 1)$ h) $(\sqrt{3} + 2)(\sqrt{3} - 1)$

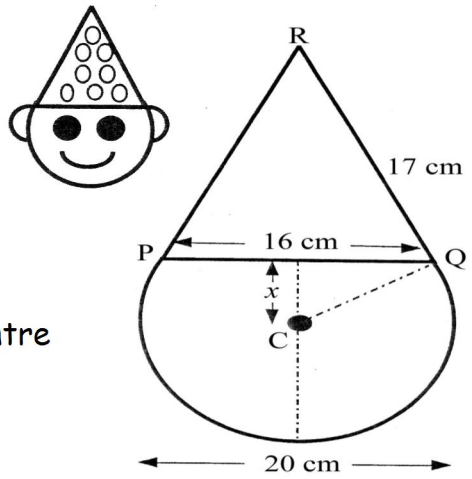
2. Rationalise the denominator and simplify where possible.

b) $\frac{10}{\sqrt{5}}$ b) $\frac{3}{2\sqrt{5}}$ c) $\frac{4}{5\sqrt{2}}$ d) $\frac{\sqrt{4}}{\sqrt{3}}$

3. Mrs Kilgour invests £6500 with her bank. The interest rate is 2.7% p.a. She leaves the money and the interest in the account for 5 years. How much money will be in the account at the end of the fifth year?

4. A clown's face consists of an isosceles triangle PQR on top of a sector of a circle.

The diameter of the circle is 20 centimetres.
The base of the triangle is 16 centimetres and its sloping sides are 17 centimetres long.



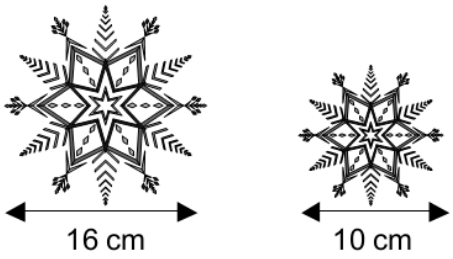
a) Calculate x, the distance in cm from the centre of the circle to the base of the triangle.

b) Calculate the total height of the figure.

5. Two Christmas decorations are mathematically similar similar in shape.

The larger decoration has an area of 128 cm^2.

Calculate the area of the smaller decoration.



Unit 3 Mixed Homework 2

1. Expand and simplify:-

   a) $\sqrt{2}(5+\sqrt{2})$ b) $\sqrt{5}(\sqrt{5}+2)$ c) $(\sqrt{2}+3)(\sqrt{2}-1)$

2. Calculate (*without the use of a calculator and showing working*):

   (a) $9^{\frac{3}{2}}$ (b) $8^{\frac{1}{3}}$ (c) $16^{-\frac{3}{4}}$ (d) $\dfrac{1}{27^{\frac{2}{3}}}$

3. Simplify:

   (a) $\dfrac{y^{-\frac{1}{3}} \times y^{\frac{4}{3}}}{y}$ (b) $\dfrac{x^{-\frac{1}{5}} \times x^{\frac{6}{5}}}{x^{-2}}$ (c) $n^{-\frac{1}{2}}(n^{\frac{3}{2}} - n^{-\frac{1}{2}})$

3 Change the subject of this formula to d: $F = \dfrac{GMm}{d^2}$.

4

a) Vestal trains records how late six of it's trains are, in minutes. The results were

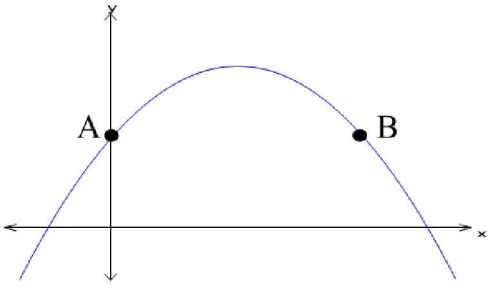
5 5 6 7 8 8

Calculate the mean standard deviation of these figures.

b) Enretard Trains also check how late their trains are and find that their means is 4.1 and standard deviation is 5.2

Compare the results for Enretard with Vestal.

5 The parabola sketched below has equation $y = 20 - (x-3)^2$.



(a) State the coordinates of the maximum turning point.
(b) State the equation of the axis of symmetry.
(c) A is the point where the graph crosses the y-axis, and B has the same y-coordinate as A.
Find the coordinates of A and B.

Unit 3 Mixed Homework 3

1 Solve **algebraically**, the equations:

a) $x^2 + 7x + 12 = 0$ b) $2x^2 + 5x - 12 = 0$

2 Express each of the following with a *rational denominator* and simplify where possible:

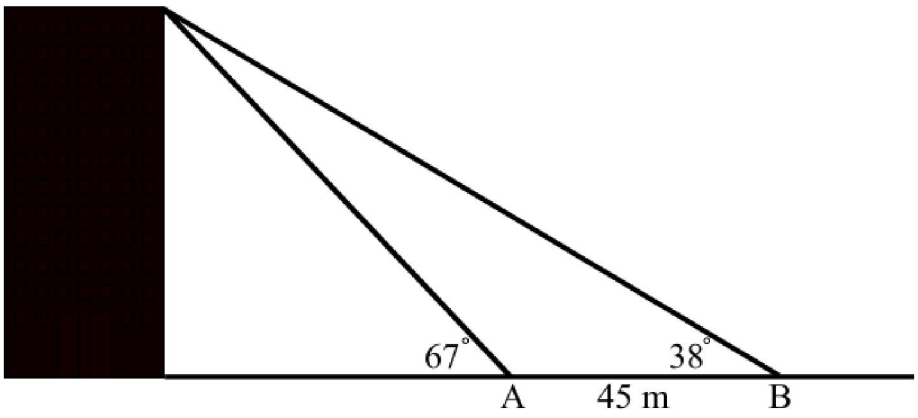
a) $\frac{1}{\sqrt{5}}$ b) $\frac{35}{\sqrt{7}}$ c) $\frac{3\sqrt{2}}{\sqrt{24}}$ d) $\frac{4}{1+\sqrt{3}}$

3 Write the following in the form $(x + a)^2 + b$ and write down the minimum value of each one.

a) $x^2 + 10x$ b) $x^2 + 6x + 2$ c) $x^2 - 8x + 8$

4 Find the two roots of the equation $2x^2 - 3x - 4 = 0$
(Answer correct to 1 decimal place).

5 AB has length 45m and the angles of elevation from A and B to the top of the building are as indicated.
Calculate the height of the building.



Unit 3 Mixed Homework 4

1 Simplify

(a) $\frac{1}{a-1}-\frac{2}{a+1}, \quad a \neq \pm 1$ (b) $\frac{3}{x^2}+\frac{2}{x^3}, \quad x \neq 0.$

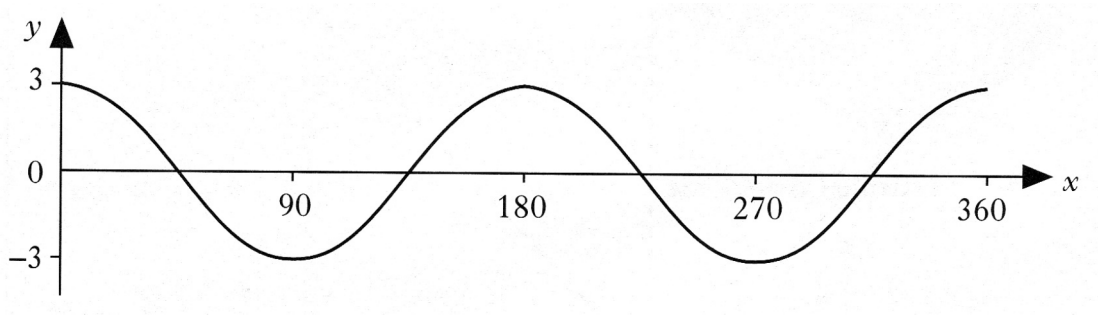
2 Express each of the following with a *rational denominator* and simplify where possible:

a) $\frac{1}{\sqrt{5}}$ b) $\frac{35}{\sqrt{7}}$ c) $\frac{3\sqrt{2}}{\sqrt{24}}$ d) $\frac{4}{1+\sqrt{3}}$

3 Solve **algebraically**:

a) $x^2 + 11x + 28 = 0$ b) $2p^2 + 12p + 10 = 0$

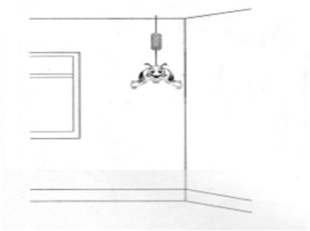
4



The diagram shows the graph of $y = a\cos bx°$, $0 \leq x \leq 360$

Find the values of a and b.

5 A toy is hanging by a spring from the ceiling.
Once the toy is set moving, the height, H metres, of the toy above the floor is given by the formula $h = 1.9 + 0.3\cos(30t)°$ t seconds after starting to move.



a) State the maximum value of H.

b) Calculate the height of the toy above the floor after 8 seconds.

c) When is the height of the toy first 2.05 metres above the floor?

Unit 3 Mixed Homework 5

1. Simplify:

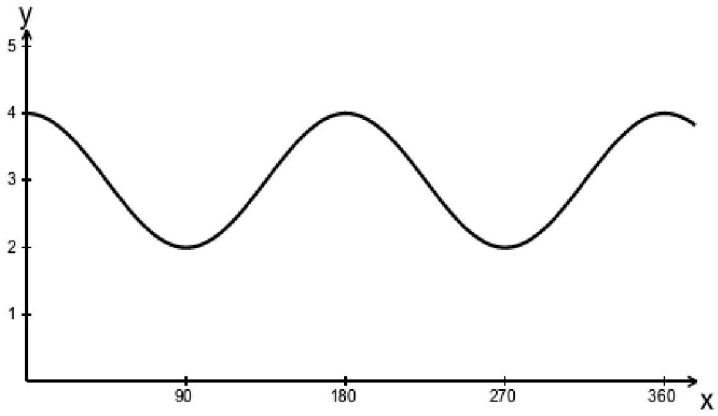
(a) $3t^{-\frac{2}{3}} \times 2t$ (b) $(x^{\frac{1}{3}})^3$ (c) $\dfrac{2m^3 \times m^{-3}}{m^2}$ (d) $\dfrac{y^{12}}{y^3 \times y^4}$

2. Solve the following equations for $0 \le x \le 360°$:

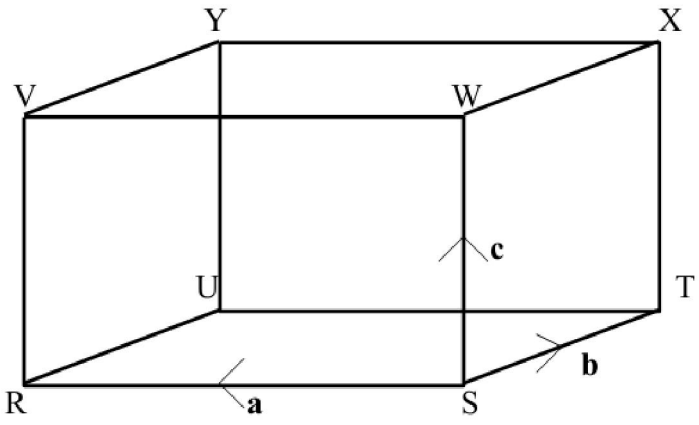
(a) $3\sin x = 2$ (b) $4\cos x = -3$
(c) $3\tan x + 2 = -4$ (d) $\cos^2 x = 0.64$

3. Part of the graph of $y = a\cos bx + c$ is shown:

State the values of a, b and c.



4. In the diagram below RSTU, VWXY represents a cuboid.
$\overrightarrow{SR}$ represents vector **a**, $\overrightarrow{ST}$ represents vector **b** and $\overrightarrow{SW}$ represents vector **c**.



Express the following vectors in terms of **a** and/or **b** and /or **c**.

(a) $\overrightarrow{RT}$ (b) $\overrightarrow{UX}$ (c) $\overrightarrow{RX}$ (d) $\overrightarrow{VT}$

5. Explain, using the quadratic formula, why the equation $x^2 + x + 4 = 0$ has no real solutions.

Unit 3 Mixed
Homework 6

1. Multiply out and simplify:

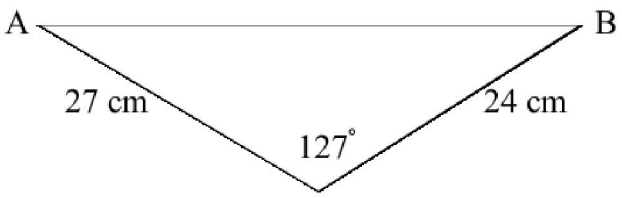
(a) $(2x+1)^2+(x-2)^2$ (b) $12x-(x-1)^2$ (c) $(x-4)^2-5(x-3)$

2. Simplify, leaving your answer in surd form:

(a) $\sqrt{2}\times\sqrt{6}$ (b) $\dfrac{\sqrt{96}}{\sqrt{3}}$ (c) $\sqrt{24}$ (d) $\dfrac{1}{\sqrt{50}}$

3. In the triangle sketched below,

(a) Calculate the length of AB.
(b) Calculate the area of the triangle.



4. $\mathbf{u}=\begin{pmatrix}2\\-3\end{pmatrix}$ and $\mathbf{v}=\begin{pmatrix}-4\\1\end{pmatrix}$.

(a) Find $2\mathbf{u}-3\mathbf{v}$
(b) Find $|2\mathbf{u}-3\mathbf{v}|$

5.

(a) Show that $\dfrac{2\sin^2 x^\circ}{1-\sin^2 x^\circ}=2\tan^2 x^\circ$.

(b) Show that $\left(\cos x^\circ+\sin x^\circ\right)^2-2\cos x^\circ\sin x^\circ=1$.

(c) Show that $\cos^3 x^\circ+\cos x^\circ\sin^2 x^\circ=\cos x^\circ$.

6. The population of Aytoon is 48000 and increasing at 2·4% p.a.
The population of Beetoon is 60000 and decreasing at 4·6% p.a.
In how many years will the population of Aytoon exceed the population of Beetoon?

Course Revision
Homework A

1. An order of three hamburgers and 2 portions of chips came to £4.10. A second order of 4 hamburgers and 3 portions of chips cost £5.70.
Let h pence represent the cost of 1 hamburger.
Let c pence represent the cost of a portion of chips.

(a) Write down two equations in h and c.

(b) Solve the two equations simultaneously to find the cost of a hamburger and a portion of chips.

2. Solve the following equations for $0 \le x \le 360$.

(a) $5\sin x = -4$ (b) $7\tan x + 6 = 9$ (c) $8\cos x + 3 = -2$

3. Simplify:

(a) $3t^{-\frac{2}{3}} \times 2t$ (b) $(x^{\frac{1}{3}})^3$ (c) $\dfrac{2m^3 \times m^{-3}}{m^2}$ (d) $\dfrac{y^{12}}{y^3 \times y^4}$

4. Simplify, leaving your answer in surd form:

(a) $\sqrt{2} \times \sqrt{6}$ (b) $\dfrac{\sqrt{96}}{\sqrt{3}}$ (c) $\sqrt{24}$ (d) $\dfrac{1}{\sqrt{50}}$

5. When a silk fan is opened it forms a sector of a circle with an angle of $160°$ at the centre. The distance from the centre to the edge of the fan is 18cm. Calculate the area of the material in the fan.

6. The famous McGlumpher earrings were bought in 1990 for £7400and sold in 1997 for £12500.
Find the percentage appreciation in value.
(*Give your answer correct to three significant figures)*

Course Revision
Homework B

1. Multiply out and tidy up

(a) $(2x+3)^2-(x-4)^2$ (b) $20-(x-7)^2$ (c) $(2x+1)^2-(x+1)(x-2)$

2. Write the following in positive index form:

(a) x^{-7} (b) $x^{-\frac{1}{2}}$ (c) $3x^{-\frac{1}{2}}$ (d) $\frac{4x^{-6}}{7}$ (e) $\frac{2}{3}x^{-9}$

3. A plot of land was bought three years ago for £21 500. It has appreciated each year by 2% of its value at the start of each year.
How much is the land worth today?

4. A golf ball has a diameter of 4.2cm. Calculate its volume to 3 s.f.

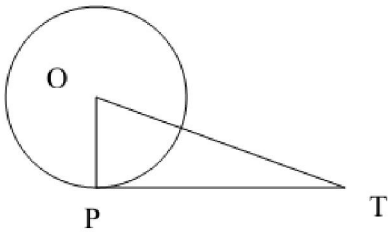
Volume of a sphere
$V = \frac{4}{3}\pi r^3$

where r is the radius

5. Factorise:

(a) $5u^2+15u-20$ (b) $3e^2+20e-7$ (c) $6y^2-27y+12$

6. PT is a tangent to the circle with centre O and radius OP=6*cm*. PT is 12*cm* long. Calculate the distance OT.



7. Solve:

(a) $4\cos x-3=-5$ (b) $2\tan x+4=7$ (c) $\sin x-12=-12.8$

8. Change the subject of the formula to H:

$L = \frac{1}{4}(H^2 + M)$

Course Revision
Homework C

1. Simplify the following:

(a) $7a \times 3a^2b$ (b) $r^2 \times \frac{p}{r}$ (c) $-4p \times (pqg)^2$

(d) $33vw^3 \div 11vw$ (e) $42xy^2 \div 6x^2y$ (f) $f^2g((3g-2f)$

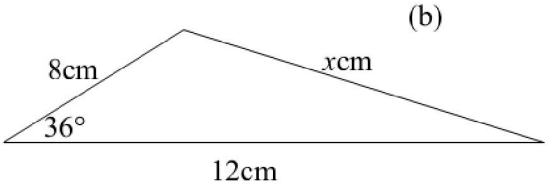
2. Expand and simplify:

(a) $8x(5x-6)-3(x+4)^2$ (b) $x^2(5x-7)+4x(3x+2)-x^2$

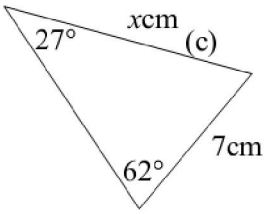
(c) $2(3k+4j)(3k-4j)$ (d) $9(x-3)^2-4(x-2)-x^2$

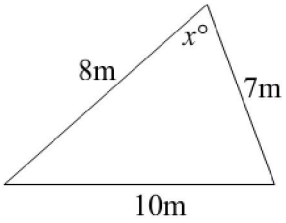
3. Find x in each triangle.

(b)



(c)



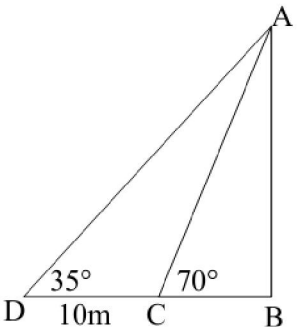


4. In the diagram telegraph pole AB is supported by wires AC and AD.

Find

(a) the length of AC.

(b) the height of the pole.

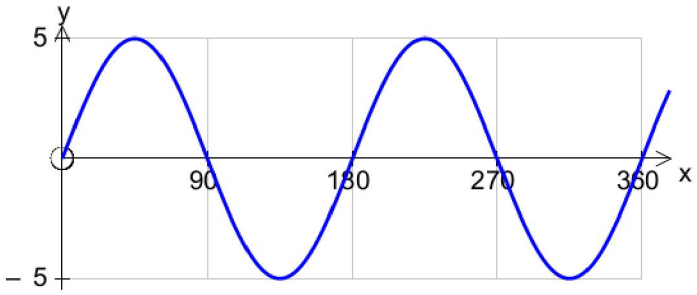


5. Simplify the following

(a) $\sqrt{12} \times \sqrt{3}$ (b) $\sqrt{8} \times \sqrt{12}$ (c) $3\sqrt{2} \times 5\sqrt{2}$ (d) $\sqrt{3}(\sqrt{3}-1)$

Course Revision
Homework D

1. The sketch below shows the graph of $y = k\sin nx^\circ$.
Write down the value of k and n.



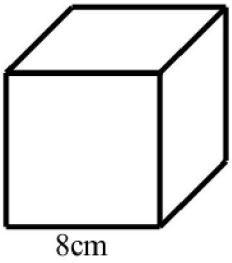
2. A function is defined by $f(x) = \sqrt{x^2 + 8}$.

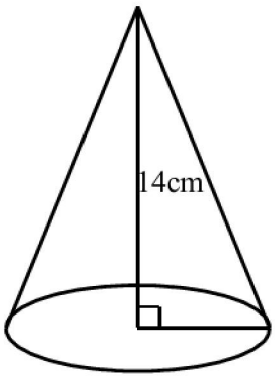
(a) Evaluate $f(2)$ and f 8 .

(b) If $f(2) \times f(8) = k\sqrt{6}$, where k is a whole number, find the value of k.

(c) Express $f(10)$ as a surd in its simplest form.

3. The cube shown below has edges of length 8cm.
The cone has height 14cm.
If the two solids have equal volumes, calculate the radius of the cone.
[volume of a cone is $V = \frac{1}{3}\pi r^2 h$.]





4. (a) Do a five-figure summary for the data shown below.

8 13 17 23 24 27 29 31 35 39 40 43

(b) Draw a box-plot to show your results for part (a).

(c) Find the range.

(d) Find the semi-interquartile range.

Auchinleck Academy

Course Revision
Homework E

1. (a) By "completing the square", show that $x^2 - 4x + 9 \geq 5$ for all real x.

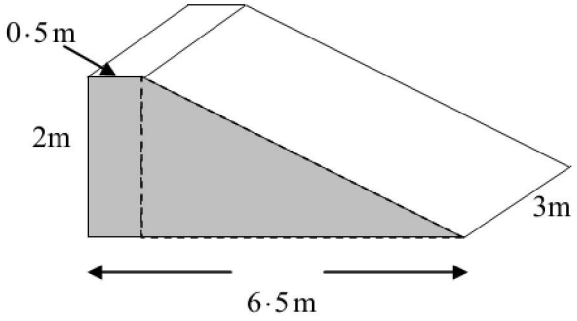
(b) At what value of x does the minimum occur?

2. Factorise:

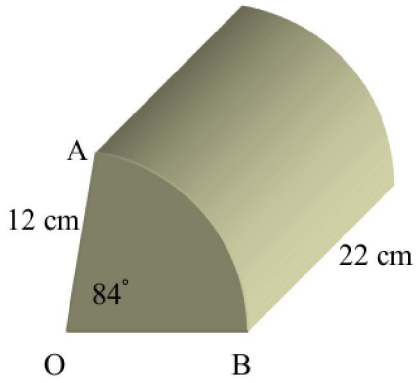
(a) $d^2 - 2d + 1$ (b) $2x^2 + 4x + 2$ (c) $9m^2 - 16n^2$

(d) $2a^2 - 7a + 3$ (e) $a^2 - 5ab + 6b^2$ (f) $8x^2 - 2x - 3$

3. Find the volume of the solid sketched below. Give your answer in litres.



4. The cross-section of the prism sketched below is a sector of a circle of radius 12 cm.
The prism has length 22 cm and $\angle AOB = 84^\circ$.
Calculate the volume of the prism, correct to three significant figures.



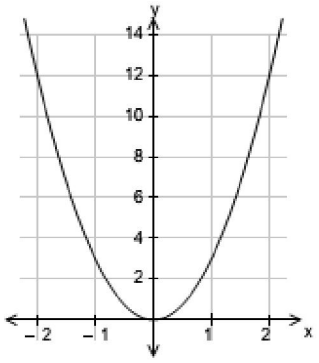
5. A tank contains 180 litres of water.
The water flows out at a constant rate of 30 litres per minute.

(a) Draw an accurate graph of the volume V, of water in the tank against the time t, in minutes.
(b) How long does it take for the volume to fall to 135 litres?

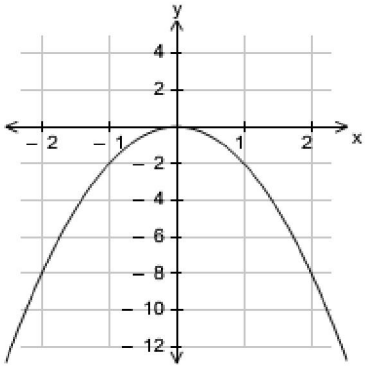
Course Revision
Homework F

1. Each of these diagrams shows the graph $y = ax^2$. find the value of a.

(a)

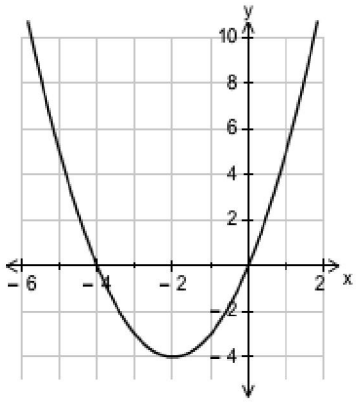


(b)

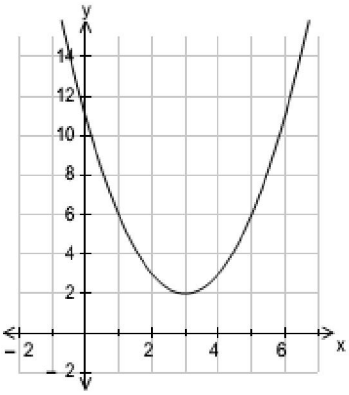


2. Each of these diagrams shows the graph of $y = (x + a)^2 + b$. Find the values of a and b.

(a)



(b)



3. The cost of hiring a car depends on the number of days the car is hired and the number of litres of petrol used.

(a) David hired a car for 3 days and used 50 litres of petrol.
The total cost was £88·50.
Let x pounds be the cost per day of hiring a car, and y pounds be the cost of one litre of petrol.
Write down an equation in x and y which satisfies the above condition.

(b) Anne hired the same model of car for 4 days and used 60 litres of petrol. The total cost was £113·00.
Write down a second equation in x and y which satisfies this condition.

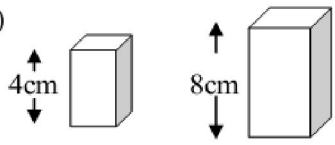
(c) Find the cost per day of hiring the car and the cost of one litre of petrol.

4. A cylindrical soft drinks can has height 15 cm and diameter 6·5 cm.
A new cylindrical can holds the same volume but has a reduced height of 12 cm.
Find the diameter of the new can, correct to 1 decimal place.

A straight line passes through the points $(4,0)$ and $(10,3)$.
Find the equation of the line in the form $y = mx + c$.

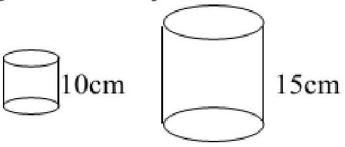
1. Pairs of mathematically similar containers are shown below.

(a)

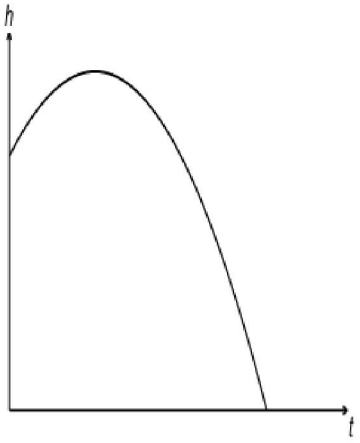


The volume of the small cuboid is $106cm^3$. Find the volume of the large one.

(b) The weight of the small container is 1.4kg. Find the weight of the larger one if they are made of the same material.

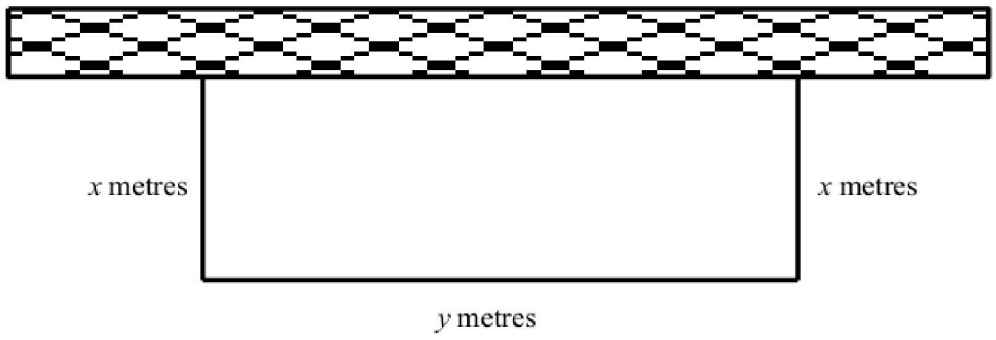


2. The diagram shows the path of a flare after it is fired.
The height, h metres above sea level, of the flare is given by $h = 48 + 8t - t^2$ where t is the number of seconds after firing.



Calculate, algebraically, the time taken for the flare to enter the sea.

3. The diagram shows a large rectangular pen to hold sheep.
One side of the rectangle is a wall and the other three sides are made of fencing.
The total length of fencing is 200 metres.



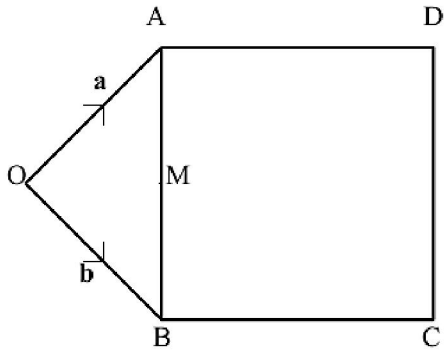
4. (a) Remove brackets and collect like terms $(3a - 2b)(2a - 5b)$.

(b) Solve algebraically the equation $2x^2 - 9x - 5 = 0$.

(c) Solve algebraically the equation $\frac{x}{2} - \frac{x+1}{3} = 4$.

Course Revision
Homework H

1. In the diagram below ABCD is a square and triangle OAB is right-angled at O with OA = OB.
Relative to the origin O, A and B have position vectors **a** and **b** respectively.



(a) Express $\overrightarrow{AB}$ in terms of **a** and **b**.

(b) If M is the mid-point of AB, express $\overrightarrow{OM}$ in terms of **a** and **b** and hence or otherwise express $\overrightarrow{OD}$ in terms of **a** and **b**.

2. The two bottles of champagne shown below are mathematically similar. If the cost of the champagne depends on the volume of the contents, find the cost of the smaller bottle if the larger one costs £44.80.
The height of the smaller bottle is 36 cm and the height of the larger one is 48 cm.

3. (a) Do a five-figure summary for the data shown below.

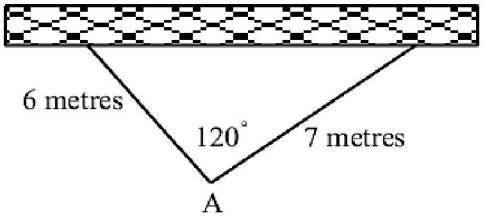
8 13 17 23 24 27 29 31 35 39 40 43

(b) Draw a box-plot to show your results for part (a).

(c) Find the range.

(d) Find the semi-interquartile range.

4. The Addams family wants to fence of a triangular part of their garden for their pet rattlesnake.
They have a long straight wall available and two straight pieces of fencing 6 metres and 7 metres in length. They first erect the fencing as shown below.



(a) Find the area enclosed by the wall and the two pieces of fencing.

(b) What size should they make angle A to maximise the area of the triangle? Justify your answer.