CHAPTER 6: TIME and SPEED

CLOCK TIME:

12 hour	6.25 am	6.25 pm	noon	midnight
24 hour	06 25	18 25	12 00	00 00 24 00

Note: 6.25 am is 6hr 25min into the day

6·25 hr is 6hr 15min

($6^1/_4$ hr)

TIME DIFFERENCES

(1) 8.25 am to 4.10 pm

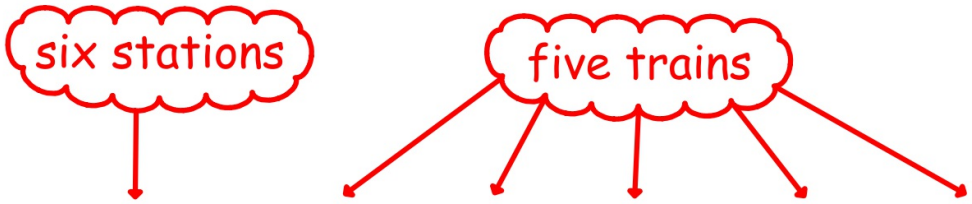
08 25 to 09 00	35 min
09 00 to 16 10	7 hr 10 min
	7 hr 45 min

(2) 10.35 pm to 2.20 am

22 35 to 24 00	1 hr 25 min
00 00 to 02 20	2 hr 20 min
	3 hr 45 min

TIMETABLES

Train timetable:



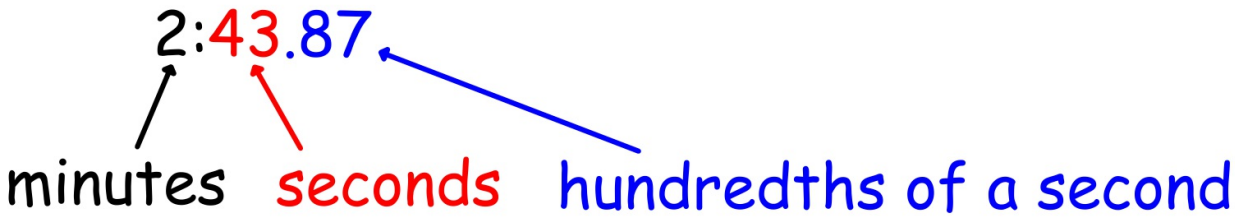
Ayton	07 20	08 00	08 40	09 20	10 00
Beeton	07 35	- - - -	08 55	09 35	10 15
Ceeton	09 55	- - - -	11 15	11 55	12 35
Deeville	10 35	- - - -	- - - -	12 35	13 15
Eville	11 05	- - - -	- - - -	13 05	13 45
F'ton	11 10	11 10	- - - -	13 10	13 50

Label train by time it leaves first station eg. the 07 20

The 08 00 train is an express train.
It passes through stations B, C, D and E without stopping.

3 trains stop at Eville: at 11 05 , 13 05 and 13 45

STOPWATCHES



2 minutes 43·87 seconds

TIME DIFFERENCES

1 minute = 60 secs

(1)

	min	sec	hundredths
	2	43	.24
−	2	41	.46
		1	·78 secs

$4\ {}^{2}\cancel{3}\ {}^{11}\cancel{2}\ {}^{1}4$

$-\ 4\ 1\ .\ 4\ 6$

$0\ 1\ .\ 7\ 8$

(2) + 60

4 83

	~~5~~	~~23~~	.87
−	3	48	.72
	1	35	.15

1 min 35·15 sec

SPEED

$S = \frac{D}{T}$

$D = ST$

$T = \frac{D}{S}$

minutes ÷ 60 = hours

hours x 60 = minutes

(1) Travel 240 miles in 4 hours 10 min.
Find the average speed.

$S = \frac{D}{T}$

= 240 ÷ 4.166666666

= 57.6 mph

10 ÷ 60 + 4

240 ÷ ANS =

(2) How far is travelled at 36 mph for 4 hours 35 min. ?

$D = ST$

= 36 x 4.583333333

= 165 miles

35 ÷ 60 + 4

(3) How long does it take to travel 100 miles at 24 mph ?

$T = \frac{D}{S}$

= 100 ÷ 24

= 4.166666666 hours

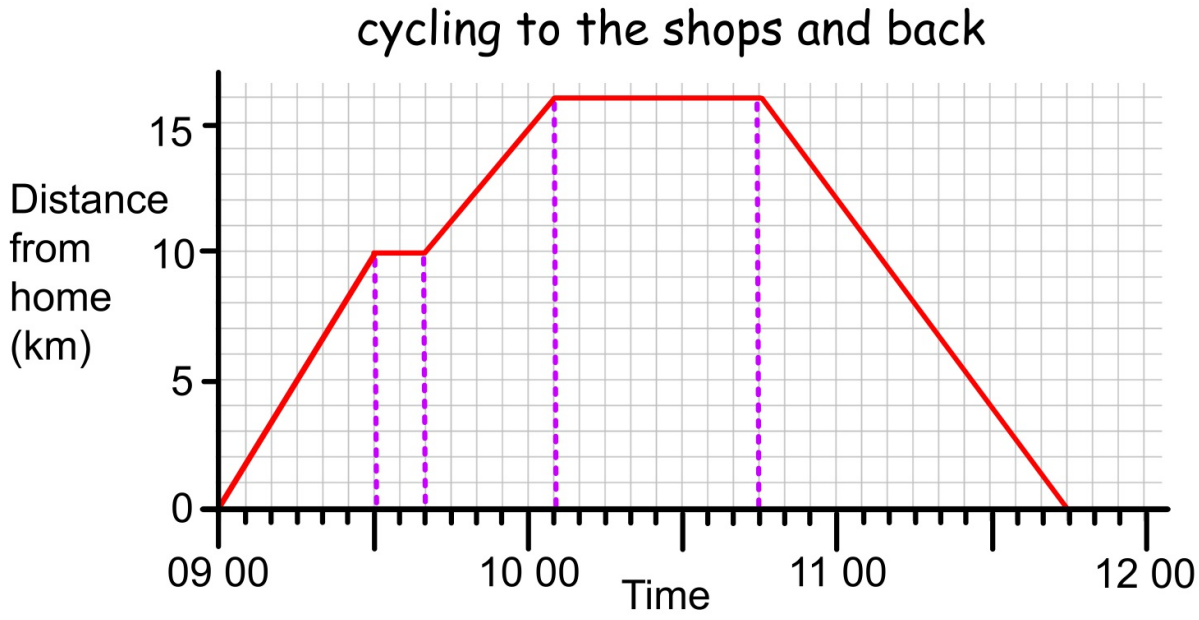
= 4 hours 10 min

- 4

0.1666... x 60 = 10

GRAPHS

For a distance/time graph, the slope is the speed.
The faster the speed the steeper the graph.



The graph tells a story of the journey:

How far is it to the shops ? 16 km

How long was he shopping ? 8 divisions 40 min

(1 division = 60 min ÷ 12 = 5 min)

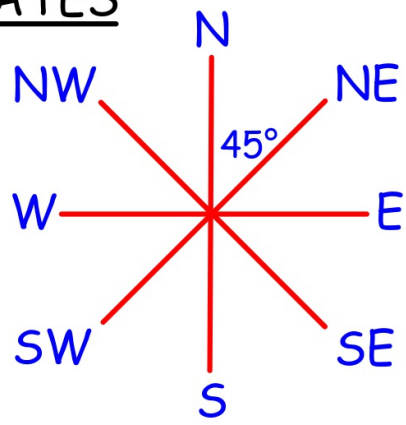
At what time did he set off for home ? 10 45

How long did he stop to repair a puncture ?

2 divisions 10 min

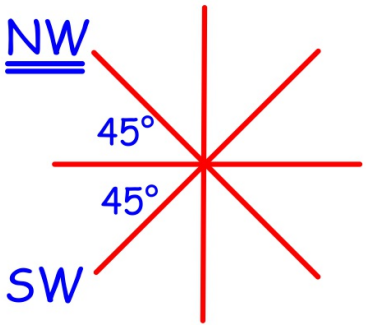
CHAPTER 7: SCALES and COORDINATES

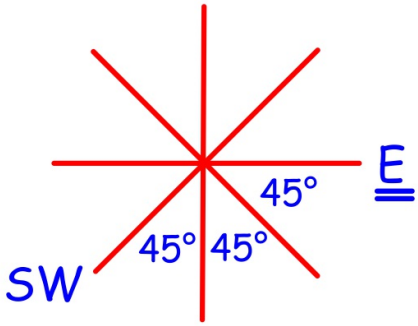
8 POINT COMPASS



Facing SW, what direction do I face after turning:

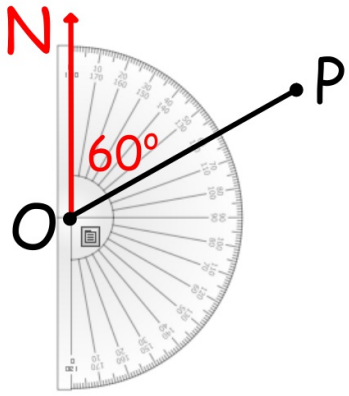
(a) clockwise 90° (b) anticlockwise 135° ?



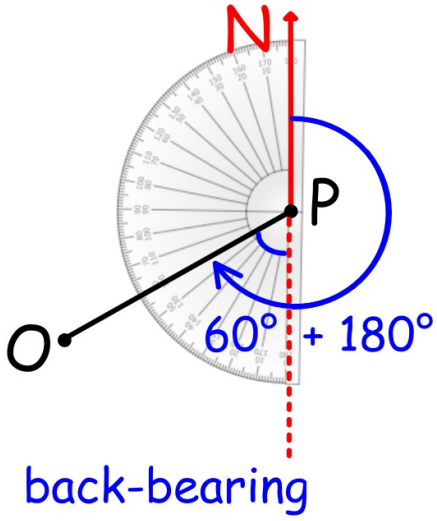


THREE FIGURE BEARINGS

The angle of turning clockwise from North.



P from O is 060°



O from P is 240°

The bearing and back-bearing differ by 180°

SCALE AS RATIO: REPRESENTATIVE FRACTION

1 cm = 2 km

1 cm : 2 km
= 1 cm : 2 000 m
= 1 cm : 200 000 cm
= 1 : 200 000

(i) 1 : 200 000
map distance 7.2 cm
real distance: ?

7.2 cm x 200 000
= 1 440 000 cm
= 14 400 m
= 14.4 km

(ii) 1 : 50 000
real distance 3.4 km
map distance: ?

3.4 km ÷ 50 000
= 3 400 m ÷ 50 000
= 340 000 cm ÷ 50 000
= 34 cm ÷ 5
= 6.8 cm

(iii) real distance 7 m
map distance 3.5 cm
representative fraction: ?

3.5 cm : 7 m
= 3.5 cm : 700 cm
= 1 : 200

by 700 ÷ 3.5

SCALE DRAWING

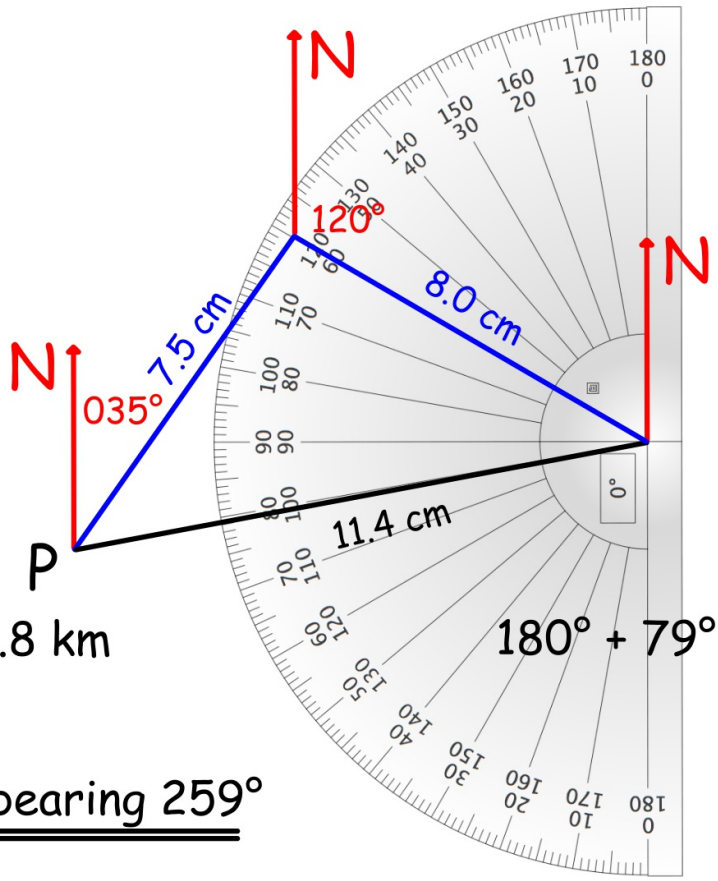
Suitable scale for a big diagram.
Neat and accurate, labelled with lengths and angles
Write the measurements made and all the calculations

A ship leaves port and sails for 15 km on bearing 035° and then for 16 km on bearing 120°.

Find the distance and bearing to return to port.

1 cm = 2 km

15.0 ÷ 2 = 7.5 cm
16.0 ÷ 2 = 8.0 cm



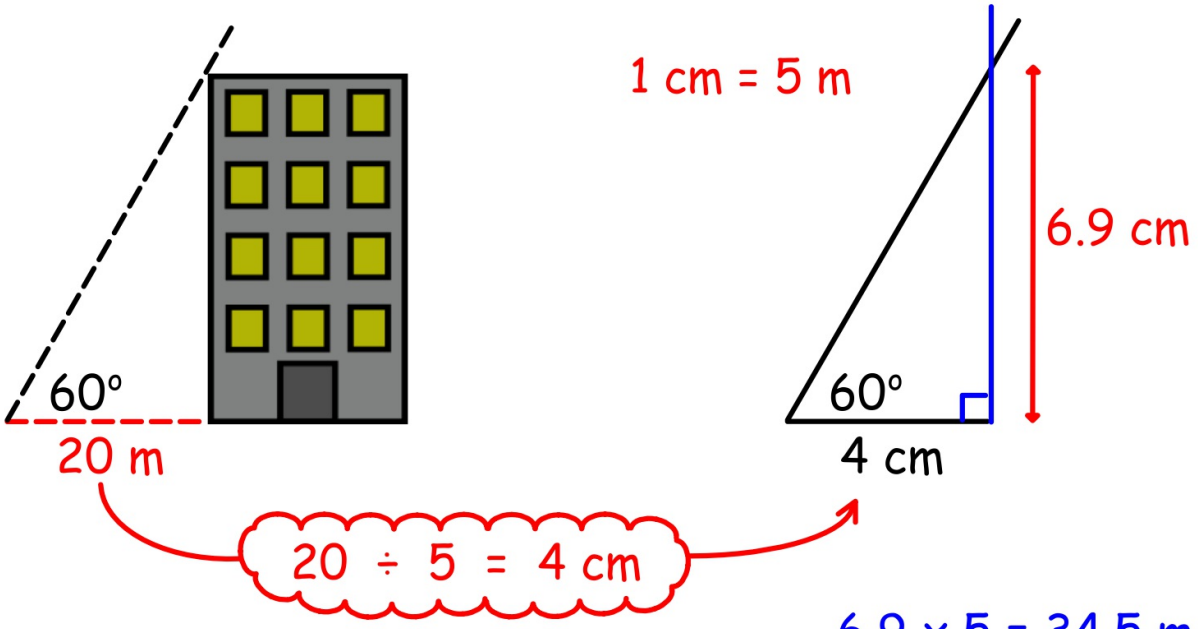
11.4 x 2 = 22.8 km

180° + 79° = 259°

22.8 km on bearing 259°

SCALE DRAWING

Find the height of the building.



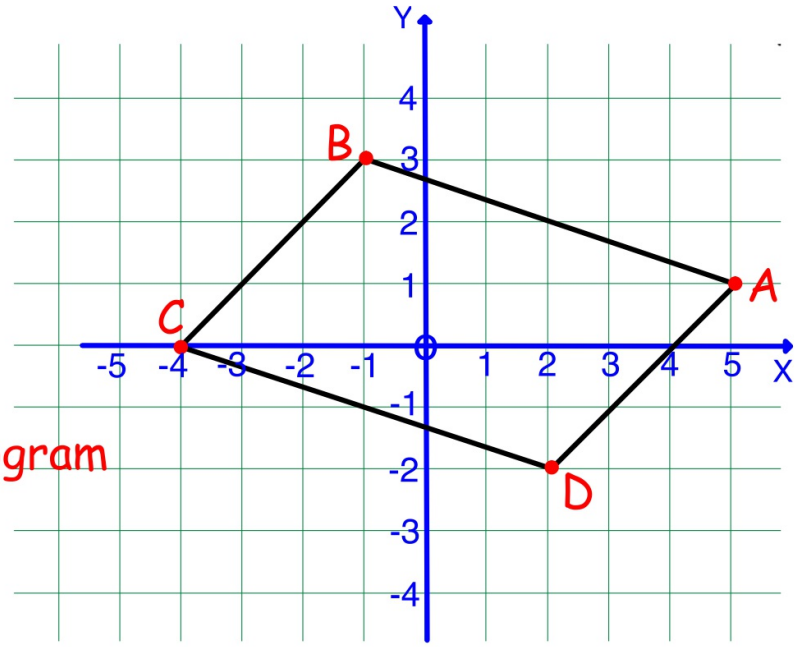
COORDINATES

A (5,1) x-coordinate is 5
y-coordinate is 1

B (-1,3)

C (-4,0)

D (2,-2)



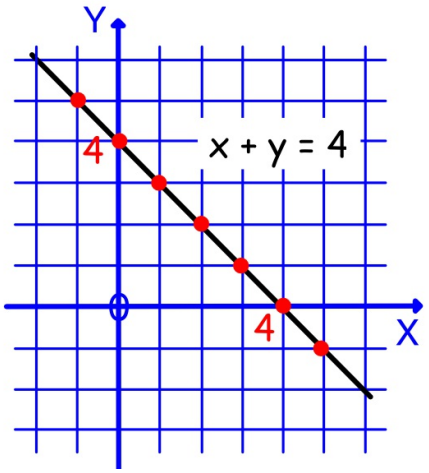
ABCD is a parallelogram

LINES

The equation gives a rule connecting the x and y coordinates of any point on the line.

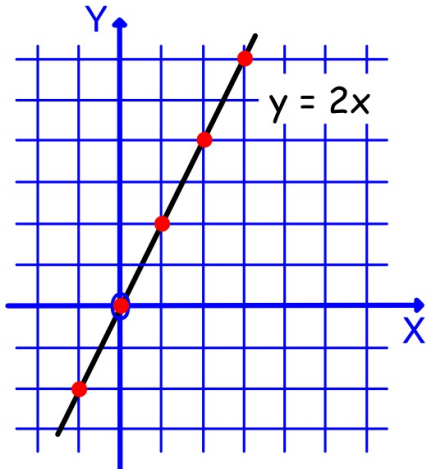
x + y = 4

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



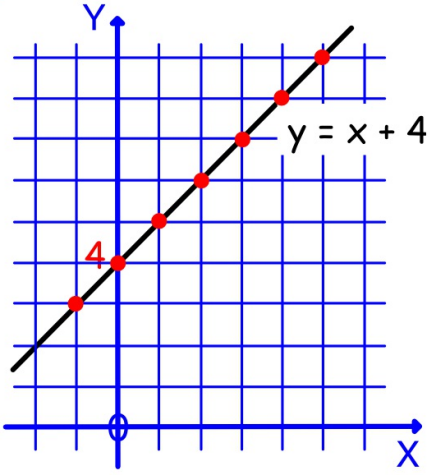
y = 2x

x	-1	0	1	2	3
y	-2	0	2	4	6

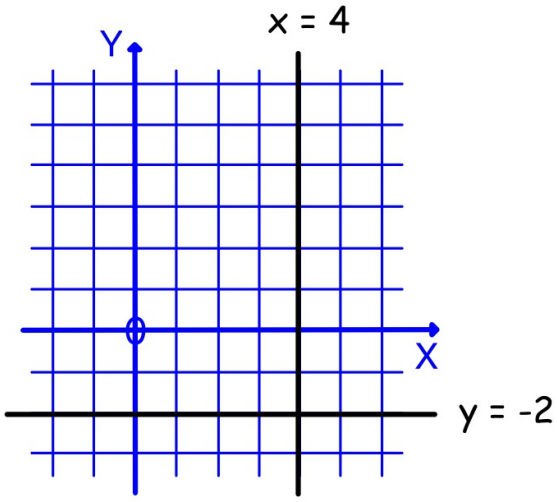


y = x + 4

x	-1	0	1	2	3	4	5
y	3	4	5	6	7	8	9



VERTICAL and HORIZONTAL lines



CHAPTER 8: EQUATIONS and INEQUATIONS

SIMPLE EQUATIONS: 'cover-up' type

isolate the term with the letter

(1) $2x - 3 = 11$

$2x = 14$

$x = 7$

(2) $21 = 6 + 5a$

$5a = 15$

$a = 3$

(3) $17 - 3w = 5$

$3w = 12$

$w = 4$

(4) $\frac{1}{2}h - 3 = 2$

$\frac{1}{2}h = 5$

$h = 10$

LETTERS ON BOTH SIDES - get letters on one side

(1) $5x - 2 = 2x + 10$ subtract 2x from each side

$3x - 2 = 10$ add 2 to each side

$3x = 12$ divide each side by 3

$x = 4$

(2) $2 + 3n = 5 - 4n$ add 4n to each side

$2 + 7n = 5$ subtract 2 from each side

$7n = 3$ divide each side by 7

$n = \frac{3}{7}$

EQUATIONS and negatives

(1) $17 - 2y = 3$ — subtract 17 from each side

$-2y = -14$ — divide each side by -2

$y = 7$

(2) $8 + 2n = 6 - 3n$ — add 3n to each side

$8 + 5n = 6$ — subtract 8 from each side

$5n = -2$ — divide each side by 5

$n = -{}^{2}/_{5}$

EQUATIONS with fractions

first remove fractions: multiply by the denominator.

(1) $\frac{x}{2} = 5$ — multiply by 2

$x = 10$

(2) $\frac{x - 3}{4} = -2$ — multiply by 4

$x - 3 = -8$

$x = -5$

NOTE: same equations

${}^{1}/_{2}\, x = 5$ ${}^{1}/_{4}\,(x - 3) = -2$

BRACKET BREAKING

$$a \times (b + c) = a \times b + a \times c$$

(1) $3p(2p + r)$

$= 6p^2 + 3pr$

(2) $2a(3a - b + 5)$

$= 6a^2 - 2ab + 10a$

signs change when multiplying by a negative term:

(3) $-3(2w - 3y)$

$= -6w + 9y$

(4) $-n(4n + 5m)$

$= -4n^2 - 5mn$

EXPRESSIONS: remove brackets then simplify

(1) $2a + 3a(2 - 3a)$

$= 2a + 6a - 9a^2$

$= 8a - 9a^2$

no sign change

(2) $5 - 3(2a - 3)$

$= 5 - 6a + 9$

$= 14 - 6a$

sign change

EQUATIONS: remove brackets then solve

(1) $2(w + 6) = 5(w - 3)$

$2w + 12 = 5w - 15$

$12 = 3w - 15$

$27 = 3w$

$w = 9$

(2) $3y = 14 - 2(y - 3)$

$3y = 14 - 2y + 6$

$3y = 20 - 2y$

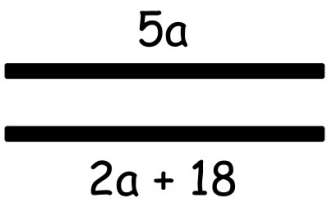
$5y = 20$

$y = 4$

PROBLEM SOLVING

Form an equation and solve.

(1) The two rods are the same length.
Find the length of the rods.

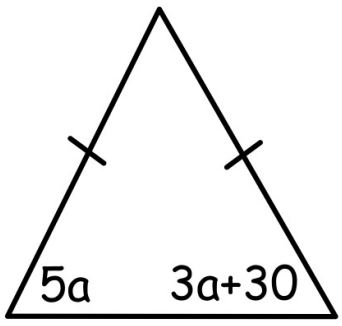


$5a = 2a + 18$
$3a = 18$
$a = 6$

$5a = 5 \times 6 = 30$
$2a + 18 = 2 \times 6 + 18 = 30$

30 cm

(2) The triangle is isosceles.
Find the size of the angles.

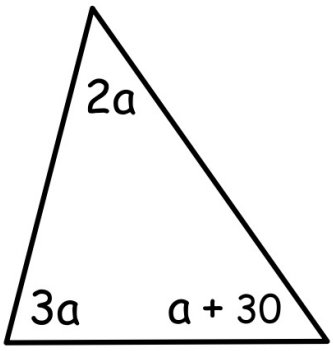


$5a = 3a + 30$
$2a = 30$
$a = 15$

$5a = 5 \times 15 = 75$
$3a + 30 = 3 \times 15 + 30 = 75$
$180 - 75 - 75 = 30$

75° , 75° , 30°

(3) Find the size of the angles.



$$3a + 2a + a + 30 = 180$$
$$6a + 30 = 180$$
$$6a = 150$$
$$a = 25$$

$3a = 3 \times 25 = 75$

$2a = 2 \times 25 = 50$

$a + 30 = 25 + 30 = 55$

check: 180

50° , 55° , 75°

(4) Alan is 8 years older than Brian.
In 3 years time Alan will be twice the age of Brian.

Find their ages.

ages Brian b years Alan $b + 8$ years

in 3 years time, Brian $b + 3$ Alan $b + 11$ years

Alan twice Brian

$$2(b + 3) = b + 11$$
$$2b + 6 = b + 11$$
$$b = 5$$

$b + 8 = 13$

Brian 5 , Alan 13

check: in 3 years 8 and 16
Alan is twice the age of Brian

INEQUALITIES (INEQUATIONS)

$>$ greater than eg. $7 > 3$

$\geq$ greater than or equal to

$<$ less than eg. $3 < 7$

$\leq$ less than or equal to

solve for $x = 1, 2, 3, 4, 5, 6$

(1) $x > 4$
$x = 5,6$

(2) $x \geq 4$
$x = 4,5,6$

(3) $x < 4$
$x = 1,2,3$

follow the same rules as equations

(1) $5x - 4 < 6$
$5x < 10$
$x < 2$

(2) $2x + 7 \leq 1$
$2x \leq -6$
$x \leq -3$

(3) $5x < 3x + 10$
$2x < 10$
$x < 5$

(4) $2x \geq 20 - 3x$
$5x \geq 20$
$x \geq 4$

x or ÷ by a negative: reverse the inequality sign

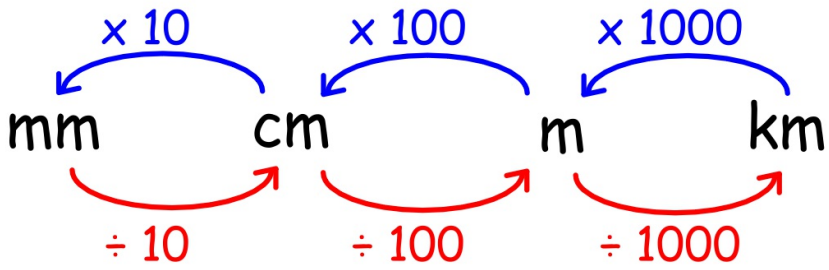
(i) $5x \geq 30$
$x \geq 6$
no sign change

(ii) $-5x \geq 30$
$x \leq -6$
sign change

CHAPTER 9: LENGTH and PYTHAGORAS' THEOREM

prefixes: milli means $^1/_{1000}$ th of
centi means $^1/_{100}$ th of
kilo means 1000 times

multiply going to smaller units



divide going to larger units

(1) change to centimetres

(a) 3.4 m 3.4 x 100 = 340 cm

(b) 18 mm 18 ÷ 10 = 1.8 cm

(2) change to metres

(a) 0.2 km 0.2 x 1000 = 200 m

(b) 520 cm 520 ÷ 100 = 5.20 m

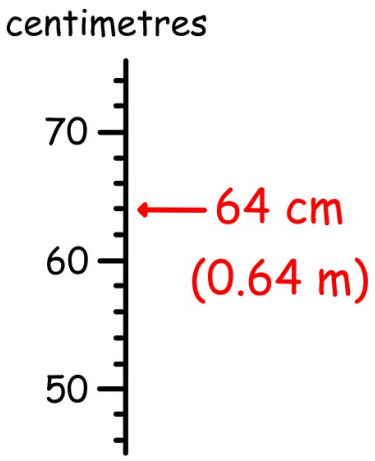
(3) change to kilometres

(a) 40 m 40 ÷ 1000 = 0.040 km

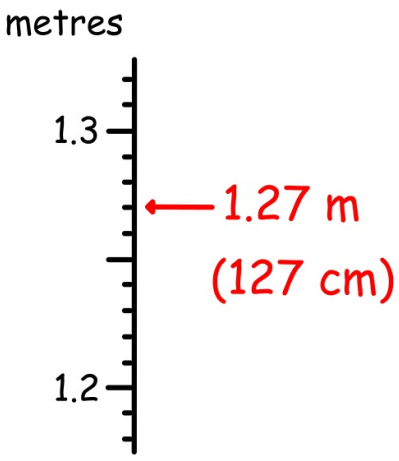
(b) 9 m 9 ÷ 1000 = 0.009 km

READING SCALES

find the value of each small division.



5 divisions = 10 cm
1 division = 2 cm

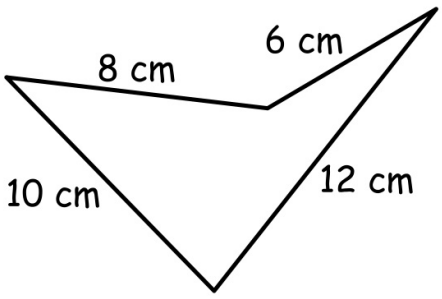


10 divisions = 0.1m (10 cm)
1 division = 0.01m (1 cm)

PERIMETER

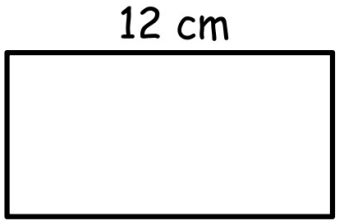
The total distance around the outside edge.

(1)



$P = 12 + 10 + 8 + 6$
$= 36$ cm

(2)

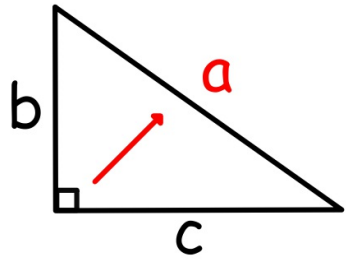


rectangle perimeter 40 cm

$P = 12 + 12 + b + b$
$40 = 24 + 2b$
$2b = 16$
$b = 8$

PYTHAGORAS' THEOREM

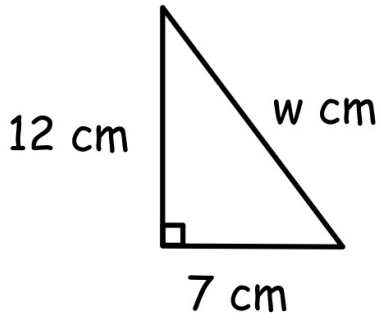
For right-angled triangles only:



$$a^2 = b^2 + c^2$$

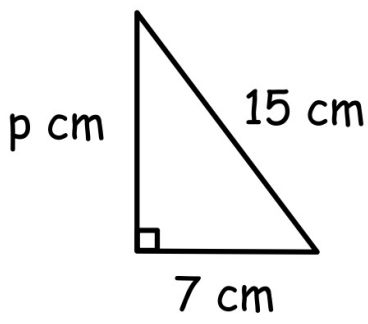
HYPOTENUSE (largest side) is opposite the 90° angle.

BIGGEST SIDE



$$w^2 = 12^2 + 7^2$$
$$= 144 + 49$$
$$= 193$$
$$w = \sqrt{193}$$
$$= 13.892...$$
$$w \approx 13.9$$

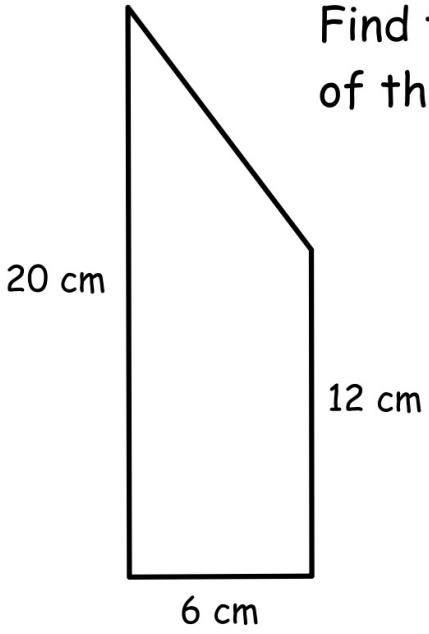
SMALLER SIDE



$$p^2 = 15^2 - 7^2$$
$$= 225 - 49$$
$$= 176$$
$$p = \sqrt{176}$$
$$= 13.266...$$
$$p \approx 13.3$$

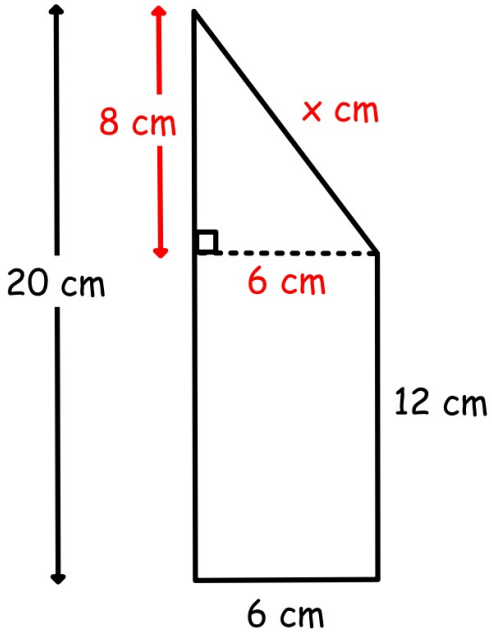
APPLYING PYTH. THM.

Identify the right angled triangle.



Find the perimeter of the shape.

height of triangle 20 cm - 12 cm = 8 cm



$x^2 = 8^2 + 6^2$

$= 64 + 36$

$= 100$

$x = 10$

P = 20cm + 6cm + 12cm + 10cm

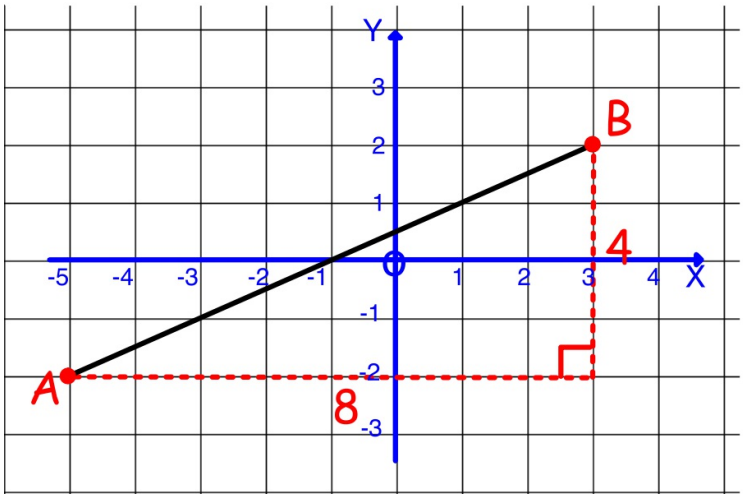
= 48 cm

DISTANCE BETWEEN TWO POINTS

Plot the points.

Construct the right-angled triangle around them.

A (-5,-2) and B (3,2)



$AB^2 = 8^2 + 4^2$

$= 64 + 16$

$= 80$

$AB = \sqrt{80}$

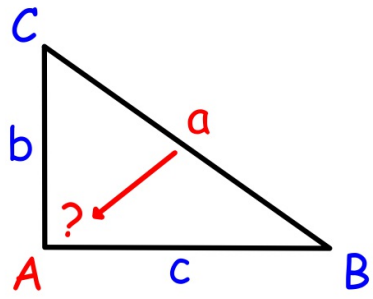
$= 8.944...$

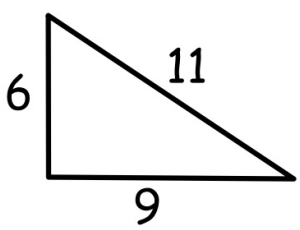
$AB \approx 8.9$ units

CONVERSE OF PYTH. THM.

if $a^2 = b^2 + c^2$

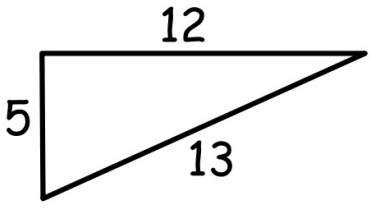
then ΔABC is right-angled





$6^2 + 9^2 \neq 11^2$

Δ is not right-angled



$5^2 + 12^2 = 13^2$

Δ is right-angled