



S1 Gap Booklet

MP 1 and 2

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Long Multiplication

Q1.
$$\begin{array}{r} 21 \\ \times 13 \\ \hline \end{array}$$

$$\begin{array}{r} 42 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 33 \\ \times 21 \\ \hline \end{array}$$

$$\begin{array}{r} 64 \\ \times 11 \\ \hline \end{array}$$

Q2.
$$\begin{array}{r} 54 \\ \times 22 \\ \hline \end{array}$$

$$\begin{array}{r} 71 \\ \times 33 \\ \hline \end{array}$$

$$\begin{array}{r} 62 \\ \times 34 \\ \hline \end{array}$$

$$\begin{array}{r} 93 \\ \times 12 \\ \hline \end{array}$$

Q3.
$$\begin{array}{r} 65 \\ \times 45 \\ \hline \end{array}$$

$$\begin{array}{r} 84 \\ \times 63 \\ \hline \end{array}$$

$$\begin{array}{r} 72 \\ \times 65 \\ \hline \end{array}$$

$$\begin{array}{r} 96 \\ \times 57 \\ \hline \end{array}$$

Q4.
$$\begin{array}{r} 88 \\ \times 72 \\ \hline \end{array}$$

$$\begin{array}{r} 95 \\ \times 26 \\ \hline \end{array}$$

$$\begin{array}{r} 53 \\ \times 84 \\ \hline \end{array}$$

$$\begin{array}{r} 90 \\ \times 99 \\ \hline \end{array}$$

Long Multiplication - Harder Examples

Q1.
$$\begin{array}{r} 121 \\ \times 13 \\ \hline \end{array}$$

$$\begin{array}{r} 342 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 233 \\ \times 21 \\ \hline \end{array}$$

Q2.
$$\begin{array}{r} 354 \\ \times 22 \\ \hline \end{array}$$

$$\begin{array}{r} 471 \\ \times 33 \\ \hline \end{array}$$

$$\begin{array}{r} 262 \\ \times 34 \\ \hline \end{array}$$

Q3.
$$\begin{array}{r} 365 \\ \times 45 \\ \hline \end{array}$$

$$\begin{array}{r} 784 \\ \times 63 \\ \hline \end{array}$$

$$\begin{array}{r} 872 \\ \times 65 \\ \hline \end{array}$$

Q4.
$$\begin{array}{r} 142 \\ \times 172 \\ \hline \end{array}$$

$$\begin{array}{r} 253 \\ \times 326 \\ \hline \end{array}$$

$$\begin{array}{r} 864 \\ \times 784 \\ \hline \end{array}$$

Decimals

Multiplying by 10, 100 and 1 000

Q1. Multiply the following by 10:

- | | | | |
|----------|----------|-----------|------------|
| a) 1.2 | b) 3.5 | c) 4.6 | d) 0.7 |
| e) 3.45 | f) 6.04 | g) 9.42 | h) 11.34 |
| i) 21.4 | j) 0.06 | k) 134.22 | l) 19.09 |
| m) 3.216 | n) 0.986 | o) 11.792 | p) 124.873 |

Q2. Multiply the following by 100:

- | | | | |
|-----------|----------|-----------|------------|
| a) 3.51 | b) 6.74 | c) 8.63 | d) 0.94 |
| e) 5.4 | f) 8.2 | g) 9.3 | h) 13.6 |
| i) 28.43 | j) 81.05 | k) 176.99 | l) 24.05 |
| m) 14.111 | n) 0.438 | o) 16.429 | p) 135.337 |

Q3. Multiply the following by 1 000:

- | | | | |
|-----------|----------|----------|-----------|
| a) 3.219 | b) 4.710 | c) 6.628 | d) 0.729 |
| e) 6.38 | f) 5.03 | g) 7.47 | h) 15.94 |
| i) 1.4 | j) 0.6 | k) 4.2 | l) 0.9 |
| m) 13.216 | n) 0.98 | o) 11.3 | p) 124.04 |

Q4. Multiply each number by i) 10 ii) 100 iii) 1 000:

- | | | | |
|----------|----------|-----------|------------|
| a) 4.56 | b) 7.72 | c) 8.37 | d) 0.16 |
| e) 5.7 | f) 4.2 | g) 29.3 | h) 63.1 |
| i) 28.47 | j) 45.06 | k) 17.992 | l) 128.5 |
| m) 134.1 | n) 0.409 | o) 266.4 | p) 135.399 |

Decimals

Dividing by 10, 100 and 1 000

Q1. Divide the following by 10:

- | | | | |
|----------|----------|-----------|----------|
| a) 31.2 | b) 15.5 | c) 14.62 | d) 20.74 |
| e) 3.4 | f) 6.2 | g) 9.42 | h) 0.35 |
| i) 121.4 | j) 20.06 | k) 156.21 | l) 16.34 |
| m) 3.216 | n) 0.9 | o) 0.02 | p) 0.001 |

Q2. Divide the following by 100:

- | | | | |
|----------|----------|----------|-----------|
| a) 123.5 | b) 426.7 | c) 218.6 | d) 300.9 |
| e) 25.4 | f) 38.2 | g) 19.37 | h) 43.605 |
| i) 8.4 | j) 1.9 | k) 6.99 | l) 5.14 |
| m) 314.1 | n) 10.4 | o) 76.4 | p) 5.39 |

Q3. Divide the following by 1 000:

- | | | | |
|----------|----------|-----------|----------|
| a) 433.2 | b) 664.3 | c) 874.6 | d) 200.7 |
| e) 56.3 | f) 45.9 | g) 97.41 | h) 85.27 |
| i) 1.4 | j) 7.6 | k) 8.2 | l) 0.9 |
| m) 13.2 | n) 0.98 | o) 11.314 | p) 0.04 |

Q4. Divide each number by i) 10 ii) 100 iii) 1 000:

- | | | | |
|-----------|-----------|-----------|------------|
| a) 224.5 | b) 547.72 | c) 868.37 | d) 400.16 |
| e) 45.7 | f) 24.26 | g) 29.3 | h) 64.17 |
| i) 8.44 | j) 42.05 | k) 37.96 | l) 128.5 |
| m) 134.11 | n) 0.4 | o) 266.49 | p) 135.399 |

Multiplying a Decimal by a Decimal

Calculate:

- | | | |
|----------------------|----------------------|-----------------------|
| a) 1.2×0.5 | b) 2.4×0.7 | c) 3.5×0.4 |
| d) 0.8×0.3 | e) 0.6×0.4 | f) 0.2×0.9 |
| g) 2.1×1.3 | h) 3.4×1.1 | i) 4.2×2.2 |
| j) 5.3×4.2 | k) 7.3×2.9 | l) 8.7×4.3 |
| m) 1.23×0.2 | n) 3.41×0.3 | o) 6.25×0.7 |
| p) 5.23×1.2 | q) 2.63×2.4 | r) 3.05×1.24 |

Integers - Adding

- | | | |
|------------------|-------------------|-------------------|
| 1. $7 + (-2)$ | 12. $(-2) + (-4)$ | 23. $(-1) + 8$ |
| 2. $5 + (-7)$ | 13. $2 + (-7)$ | 24. $6 + (-8)$ |
| 3. $2 + (-9)$ | 14. $(-2) + 1$ | 25. $10 + (-8)$ |
| 4. $2 + (-6)$ | 15. $(-3) + (-8)$ | 26. $(-6) + (-8)$ |
| 5. $0 + (-2)$ | 16. $(-3) + 6$ | 27. $(-8) + 4$ |
| 6. $6 + (-6)$ | 17. $(-6) + (-3)$ | 28. $(-4) + (-5)$ |
| 7. $(-7) + (-2)$ | 18. $(-5) + 1$ | |
| 8. $9 + (-8)$ | 19. $(-5) + (-4)$ | |
| 9. $0 + (-7)$ | 20. $(-8) + (-1)$ | |
| 10. $1 + (-3)$ | 21. $(-5) + 9$ | |
| 11. $1 + (-9)$ | 22. $(-9) + 3$ | |

Integers - Subtraction

- | | | |
|-------------------|-------------------|----------------|
| 1. $6 - (-5)$ | 12. $(-7) - 8$ | 23. $(-5) - 3$ |
| 2. $2 - (-6)$ | 13. $2 - 8$ | 24. $(-8) - 8$ |
| 3. $7 - (-1)$ | 14. $1 - 9$ | 25. $0 - 8$ |
| 4. $9 - (-6)$ | 15. $(-2) - 6$ | 26. $5 - (-3)$ |
| 5. $1 - (-3)$ | 16. $2 - 9$ | 27. $7 - (-3)$ |
| 6. $9 - (-9)$ | 17. $2 - (-12)$ | 28. $(-6) - 8$ |
| 7. $(-3) - (-7)$ | 18. $5 - (-1)$ | |
| 8. $(-1) - (-1)$ | 19. $8 - (-2)$ | |
| 9. $2 - (-3)$ | 20. $3 - (-1)$ | |
| 10. $(-4) - (-4)$ | 21. $(-5) - (-8)$ | |
| 11. $(-9) - (-7)$ | 22. $3 - (-5)$ | |

Integers - Multiplication

- | | | |
|-----------------------|------------------------|------------------------|
| 1. 8×4 | 12. $(-4) \times 7$ | 23. $9 \times (-8)$ |
| 2. $(-6) \times 7$ | 13. $(-4) \times (-3)$ | 24. $(-8) \times (-6)$ |
| 3. $(-5) \times 2$ | 14. $(-3) \times (-3)$ | 25. $(-9) \times (-3)$ |
| 4. $(-2) \times 4$ | 15. $(-5) \times (-2)$ | 26. $9 \times (-4)$ |
| 5. $5 \times (-8)$ | 16. $(-4) \times 8$ | 27. $(-9) \times 4$ |
| 6. $(-2) \times (-3)$ | 17. $(-9) \times 62$ | 28. 3×0 |
| 7. $(-4) \times (-3)$ | 18. $4 \times (-2)$ | |
| 8. $(-6) \times (-3)$ | 19. $6 \times (-7)$ | |
| 9. $(-7) \times (-6)$ | 20. $(-5) \times 9$ | |
| 10. $7 \times (-7)$ | 21. 7×7 | |
| 11. $7 \times (-6)$ | 22. $(-8) \times 4$ | |

Integers - Division

- | | | |
|-----------------------|-----------------------|-----------------------|
| 1. $30 \div (-5)$ | 12. $(-18) \div (-9)$ | 23. $18 \div (-9)$ |
| 2. $30 \div (-6)$ | 13. $(-54) \div (-6)$ | 24. $(-2) \div (-2)$ |
| 3. $24 \div (-6)$ | 14. $(-12) \div (-3)$ | 25. $32 \div (+4)$ |
| 4. $81 \div (-9)$ | 15. $(-36) \div (-4)$ | 26. $30 \div (-10)$ |
| 5. $6 \div (-1)$ | 16. $(2) \div (-2)$ | 27. $(-21) \div (-3)$ |
| 6. $(-28) \div 7$ | 17. $(0) \div (-9)$ | 28. $35 \div (-5)$ |
| 7. $(-81) \div 9$ | 18. $12 \div (-3)$ | |
| 8. $(-42) \div 6$ | 19. $(-8) \div 2$ | |
| 9. $(-30) \div 6$ | 20. $(-16) \div (-2)$ | |
| 10. $(-2) \div 1$ | 21. $(-49) \div 7$ | |
| 11. $(-30) \div (-6)$ | 22. $8 \div (-4)$ | |

Integers - Problems

1. When I got up this morning, the temperature was -3°C . By 10 o'clock it was 4°C . How many degrees had the temperature risen?
2. At sunset the temperature was 2°C and at midnight it was -7°C . How many degrees had the temperature fallen?
3. Room temperature is 12°C and the temperature outside is -2°C . What is the difference between these two temperatures?
4. The thermometer read -5°C one frosty morning, but by lunchtime it had risen by 8 degrees. What was the temperature then?
5. Inside Mrs Chidswell's fridge, the temperature is -3°C . To defrost it, she lets the temperature rise by 7 degrees. What will be the temperature then?
6. A submarine was situated 450 feet below sea level. If it descends 300 feet, what is its new position?
7. Mt. Everest, the highest elevation in Asia, is 29,028 feet above sea level. The Dead Sea, the lowest elevation, is 1,312 feet below sea level. What is the difference between these two elevations?
8. In Buffalo, New York, the temperature was -14°F in the morning. If the temperature dropped 7°F , what is the temperature now?
9. A submarine was situated 800 feet below sea level. If it ascends 250 feet, what is its new position?
10. In the Sahara Desert one day it was 136°F . In the Gobi Desert a temperature of -50°F was recorded. What is the difference between these two temperatures?
11. Metal mercury at room temperature is a liquid. Its melting point is -39°C . The freezing point of alcohol is -114°C . How much warmer is the melting point of mercury than the freezing point of alcohol?

The Square

A revision exercise

Exercise 1

1. Use a ruler to draw a neat square **ABCD** with sides 4 centimetres.

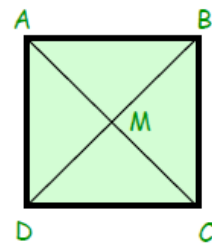
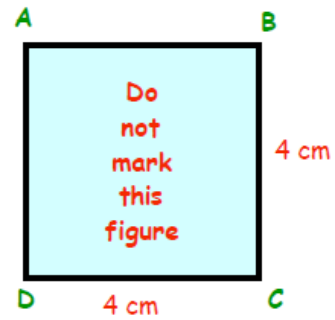
Answer the following questions about the square :-

- a Are all four sides the same length ?
- b Are the opposite pairs of sides parallel ?
- c Are all four angles the same size ?
- d How many lines of symmetry has the square ?
- e Does it have (i) $\frac{1}{2}$ turn symmetry ? (ii) $\frac{1}{4}$ turn symmetry ?
- f If this square was cut out of the page, in how many ways could it fit back in the hole left in the page ?

Now carefully draw in the two diagonals, **AC** and **BD** meeting in the middle at **M**.

- g Are the two diagonals the same length ?
- h Does each diagonal **bisect** the other one (cut it in half) ?
- i Do the two diagonals cross each other at right angles (is $\angle AMB = 90^\circ$) ?
- j Does each diagonal "bisect" the end angle (i.e. does **AC** cut $\angle BAD$ in half) ?

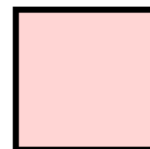
(The above are called the "**PROPERTIES**" of the square).



2. The square is the most "perfect" of all quadrilaterals.

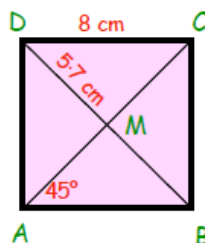
Make a list of at least 10 "properties" as follows :-

- (i) All 4 sides are the same length.
- (ii) The opposite sides are par..... .



3. Look at the square shown opposite.

- a Make a neat sketch of it.
- b Fill in the sizes of every other side and angle.

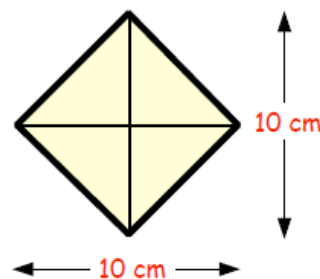


4. a Draw a square, PQRS, with sides 6 centimetres.

- b Draw in the 2 diagonals, PR and QS, and measure their lengths.

5. Harder !!

- a Draw a square with its two diagonals 10 centimetres.
(hint : make sure they bisect each other at right angles)
- b Measure the lengths of each of the sides of the square.



6. a Draw another square with its diagonals 12 centimetres.

- b Measure the lengths of each of its sides.

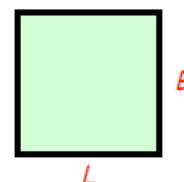
7. a Draw a square which has a PERIMETER of 28 centimetres.

- b Measure the lengths of its diagonals.

8. You learned in Chapter 10 that the area of a square is given by

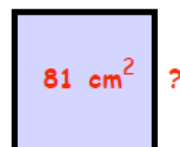
$$A = L \times B \quad (\text{or } A = L^2)$$

- a Calculate the area of a square with sides 5 cm.
- b Calculate the area of a square with sides 12 cm.
- c Calculate the area of a square with sides 3.5 cm.
- d Check that the square in Question 5, has an area of 50 cm².



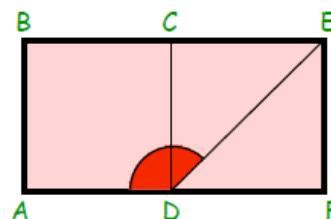
9. Harder !! A square has an area of 81 cm².

- a What is the length of each of its sides ?
- b Calculate the perimeter of the square.



10. Shown are 2 congruent squares, ABCD and DCEF, side by side.

Calculate the size of $\angle ADE$.



The Rectangle

Revision Exercise

Exercise 2

1. Use a ruler to draw rectangle PQRS
7 centimetres by 4 centimetres.

Answer the following questions
about the rectangle :-

- Are all four sides the same length ?
- Are opposite pairs of sides the same length ?
- Are opposite pairs of sides parallel ?
- Are all four angles the same size ?
- How many lines of symmetry has the rectangle ?
- Does it have (i) $\frac{1}{2}$ turn symmetry ? (ii) $\frac{1}{4}$ turn symmetry ?

- If the rectangle was cut out, in how many ways could it be fitted back into the page ?

Now carefully draw the two diagonals, PR and QS meeting in the middle at M.

- Are the two diagonals the same length ?
- Does each diagonal bisect the other one (cut it in half) ?
- Do the two diagonals cross each other at right angles (is $\angle PMQ = 90^\circ$) ?
- Does each diagonal "bisect" the end angle (is $\angle MSP = \angle MSR$) ?

(The above are called the "PROPERTIES" of the rectangle).

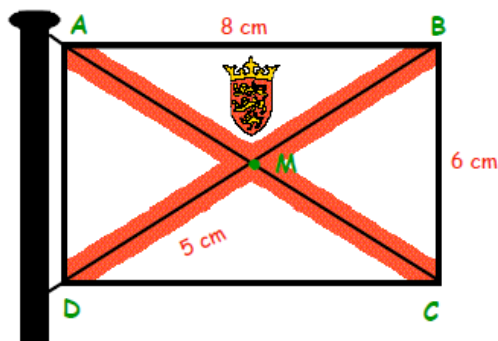
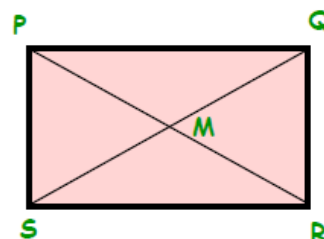
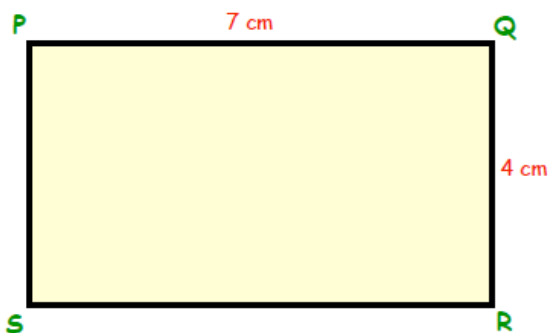
2. Make a list of 5-6 "PROPERTIES" of a rectangle which make it different from a square.

You could start like this :-

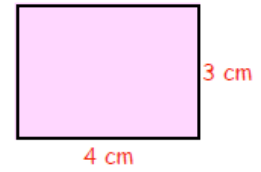
- The rectangle does **NOT** have all its four sides the same length.
-

3. Look at the rectangle shown opposite.

- Make a neat sketch of the rectangle.
- Fill in the sizes of the other five lengths.



4. a Neatly and accurately draw a rectangle measuring 4 cm by 3 cm.
 b Measure the lengths of its 2 diagonals.



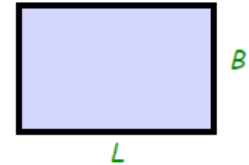
5. Draw a rectangle with its diagonals 10 centimetres long.

(note 1: start with one diagonal, find its mid-point, and draw a 2nd diagonal through this mid-point)
 (note 2: your rectangle will look different from your neighbours)

6. Draw a rectangle with its diagonals 7 centimetres long.
7. a Draw a rectangle with a perimeter of 16 centimetres.
 b Draw a different rectangle with a perimeter of 16 centimetres.
 c Draw a third rectangle with a perimeter of 16 centimetres.
 d If you start to draw a rectangle with perimeter 16 cm and you begin with one of its sides 4 cm long, what "special" type of rectangle will you end up with?

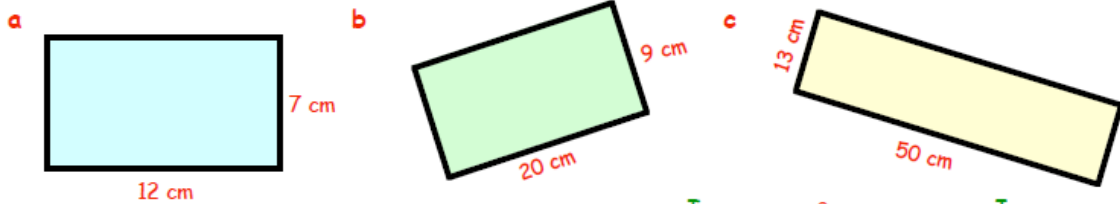
8. You learned in Chapter 10 that the area of a rectangle is given by

$$A = L \times B$$



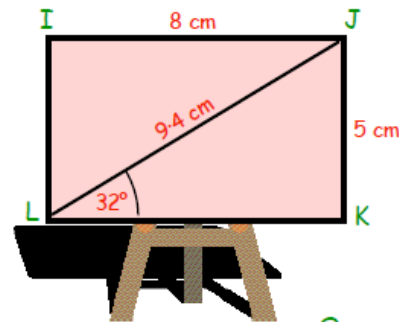
Calculate the area of a rectangle measuring 8 cm by 4 cm.

9. Calculate the areas of the following rectangles :-

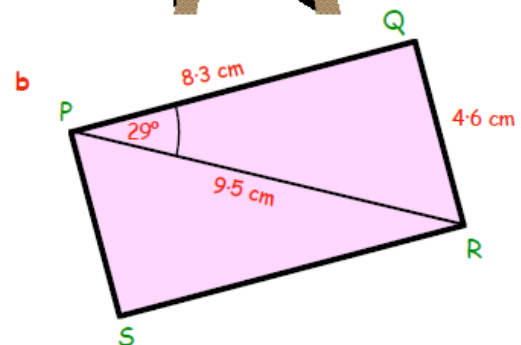
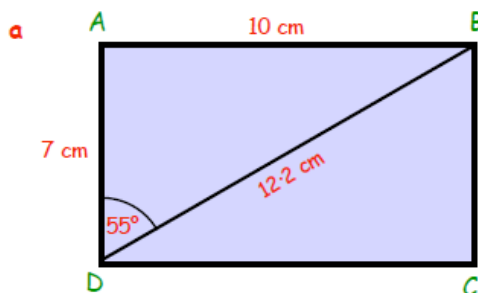


10. Look at the rectangle IJKL.

- a What are the lengths of sides, IL and LK?
 b Write down the sizes of $\angle LIJ$ and $\angle LKJ$.
 c Now calculate the sizes of the missing angles.

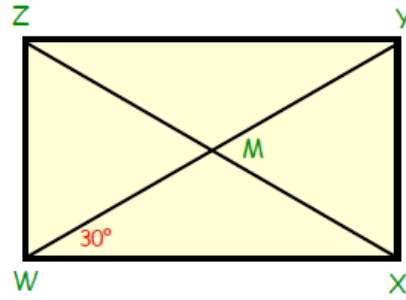


11. Sketch the following rectangles and fill in the sizes of the missing sides and angles :-

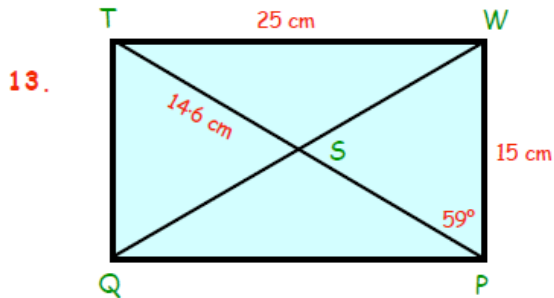


12. Look at the rectangle WXYZ.

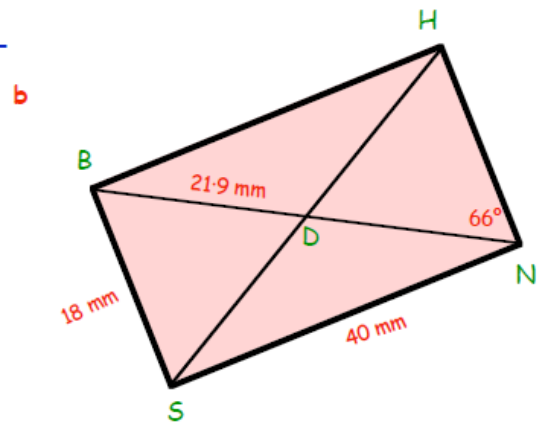
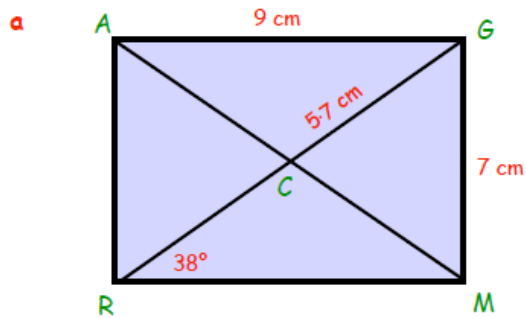
- a Calculate the size of :-
 (i) $\angle MXW$ (ii) $\angle MWZ$.
 b Sketch the figure and fill in the sizes of all the missing angles.



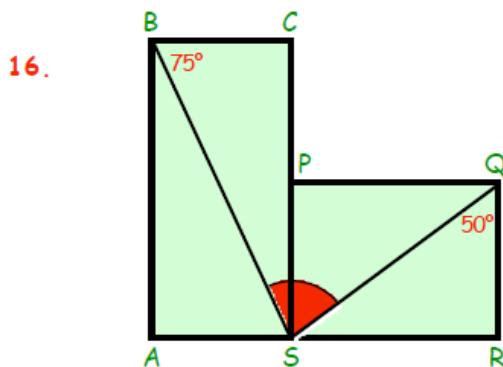
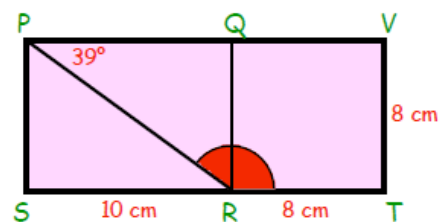
Sketch the figure TWPQ and fill in the sizes of all the missing sides and angles.



14. Do the same for the following two rectangles :-



15. Shown is a rectangle PQRS and a square QRTV.
 Calculate the size of $\angle PRT$.



Look at the 2 rectangles, ABCS and PQRS, joined at PS.

- a Make a neat sketch of this figure.
 b By working out the sizes of the missing angles, calculate the size of $\angle BSQ$.

The Other 4 Quadrilaterals

The four angles of a Quadrilateral

By this stage, you should have learned that the three angles of a triangle always add to give 180° .

$$x + y + z = 180^\circ$$

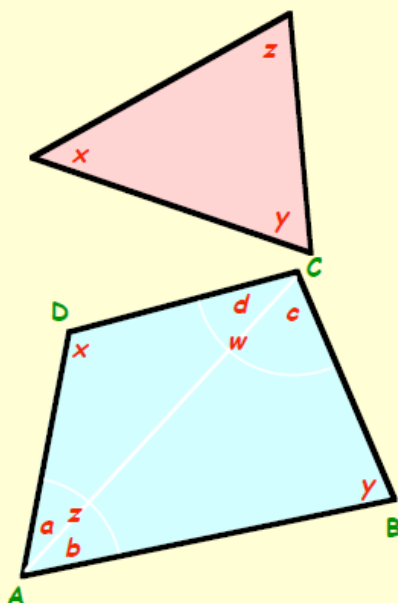
There is a similar rule connecting the four angles of a quadrilateral.

Look at $\triangle ABC$, $y + b + c = 180^\circ$

Look at $\triangle ADC$, $x + a + d = 180^\circ$

Can you see that the four angles of the quadrilateral add to

$$\begin{aligned} & x + y + z + w \\ &= x + y + (a + b) + (c + d) \\ &= (x + a + d) + (y + b + c) \\ &= 180 + 180 = 360^\circ \\ &\Rightarrow x + y + z + w = 360^\circ \end{aligned}$$

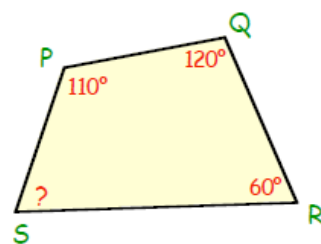


The four angles of a quadrilateral ALWAYS add to give 360°

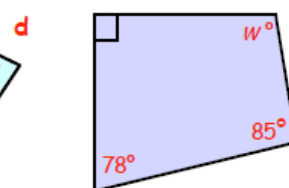
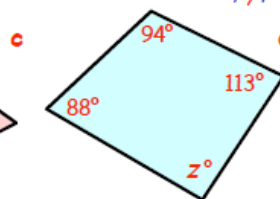
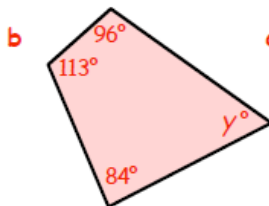
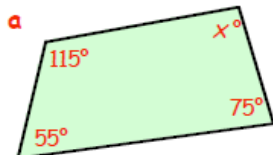
Exercise 3

1. Look at quadrilateral PQRS.

- Find $110 + 120 + 60$.
- What must the size of $\angle PSR$ be?



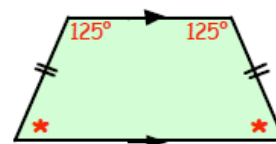
2. Sketch the following quadrilaterals and calculate the values of x , y , z and w . :-



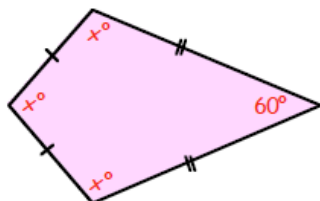
3. This shape is called a Trapezium.

(you will meet it later on)

Calculate the size of the angles marked *.



4.



Three of the angles in this kite are the same size (x).

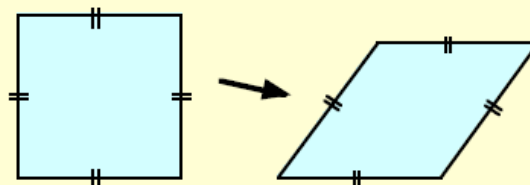
Calculate the value of x .

The Rhombus

The Rhombus (Diamond)

You can think of a rhombus as a "SQUASHED SQUARE".

it has some of the properties of a square, but not all of them.



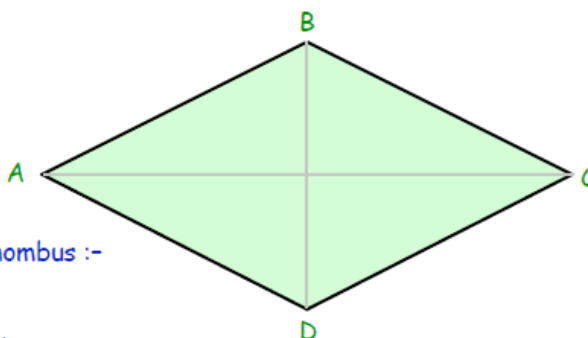
Exercise 4

1. Use a ruler to draw the following rhombus (or trace it into your jotter)

Its diagonals are 8 cm and 4 cm.

Answer the following questions about the rhombus :-

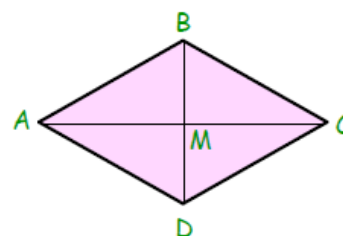
- Are all four sides the same length ?
- Are the opposite pairs of sides parallel ?
- Are all four angles the same size ?
- Are opposite pairs of angles the same size ? ($\angle BAD$ and $\angle BCD$)
- How many lines of symmetry has the rhombus ?
- Does it have (i) $\frac{1}{2}$ turn symmetry ? (ii) $\frac{1}{4}$ turn symmetry ?



- If the rhombus was cut out, in how many ways could it be fitted back in the page ?

Now carefully draw the two diagonals, AC and BD meeting in the middle at M.

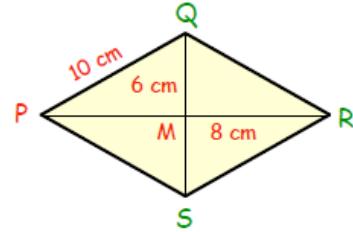
- Are the two diagonals the same length ?
- Does each diagonal bisect the other diagonal ?
- Do the two diagonals cross each other at right angles (is $\angle BMA = 90^\circ$) ?
- Does each diagonal "bisect" the end angle (i.e. is $\angle BAM = \angle DAM$) ?



(The above are called the "PROPERTIES" of the rhombus).

2. Make a list of 4-5 "PROPERTIES" of a rhombus which make it different from a square.
- The rhombus does **NOT** have all its 4 angles the same size.
 - It only has ... lines of symmetry unlike the square's 4 lines of symmetry.
 -

3. Look at the rhombus, PQRS.
- What are the lengths of the lines QR, RS and PS?
 - What are the lengths of the lines PM and SM?



4. The easiest way to draw a "NEAT" accurate rhombus is :-
- not by drawing its four sides first
 - but drawing its two diagonals first

The diagram shows how to draw a rhombus, ABCD with diagonals 8 cm and 4 cm.

Use the instructions to draw rhombus ABCD.

5. a Draw rhombus PQRS with diagonal PR = 10 cm and diagonal QS = 6 cm.
- b Measure the length of each of its 4 sides.

6. Draw a rhombus with diagonals 12 cm and 7 cm.

7. a Draw a rhombus with diagonals 6 cm and 6 cm.
- b What "special" type of rhombus have you created?

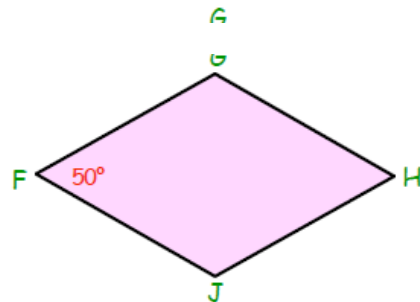
Step 1 : draw diagonal AC = 8 cm

Step 2 : find its centre

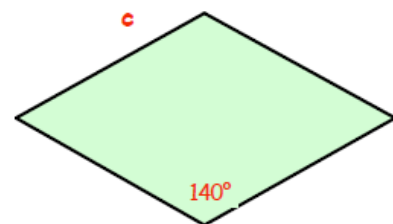
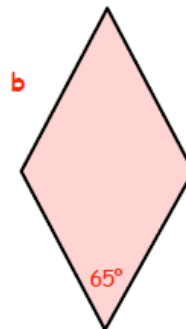
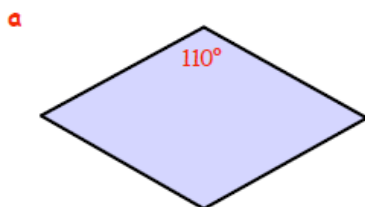
Step 3 : draw diagonals BD = 4 cm passing through M (at 90°) to AC

Step 4 : join A → B → C → D

8. Look at the rhombus FGHT.
- What is the size of :-
- $\angle GHJ$?
 - $\angle FGH$?
 - $\angle FJH$?

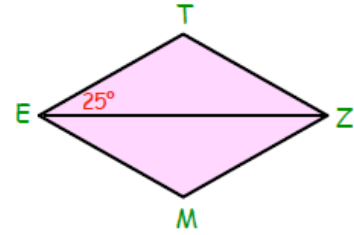


9. Write down the sizes of the missing angles in each of the following rhombii :- (plural of rhombus)

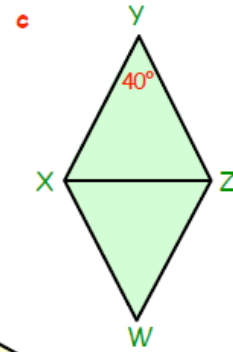
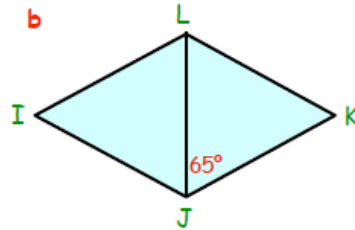
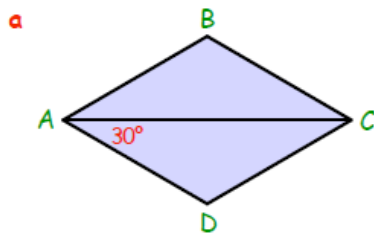


10. In this rhombus, one diagonal has been drawn.

- What "special" kind of triangle is $\triangle ETZ$?
- Write down the size of $\angle EZT$?
- Calculate the size of $\angle ETZ$.
- Write down the sizes of the other three angles.

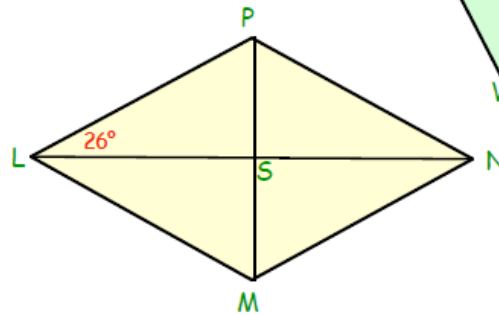


11. Make neat sketches of the following rhombii and fill in the sizes of all the missing angles :-

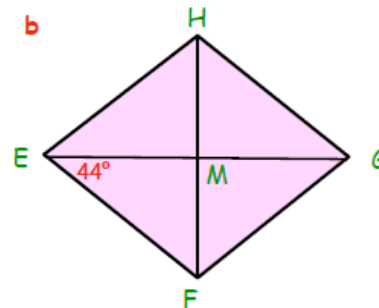
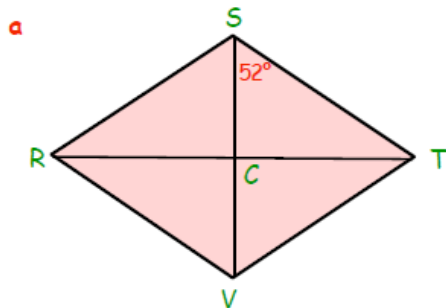


12. This time, both diagonals are shown in rhombus, LMNP.

Make a large sketch and fill in the size of all 11 missing angles.



13. Sketch these rhombii and fill in the sizes of all the missing angles :-



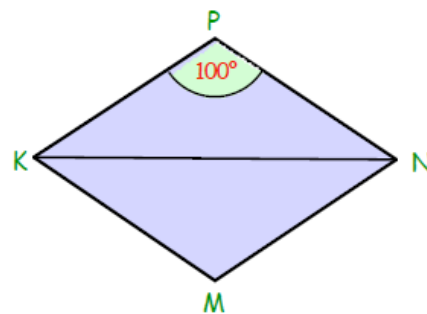
14. Look at the figure in Question 13b.

if $\angle MEF$ had been 45° instead of 44° , what "special" type of rhombus would EFGH have turned into ?

15. Look at rhombus KMNP.

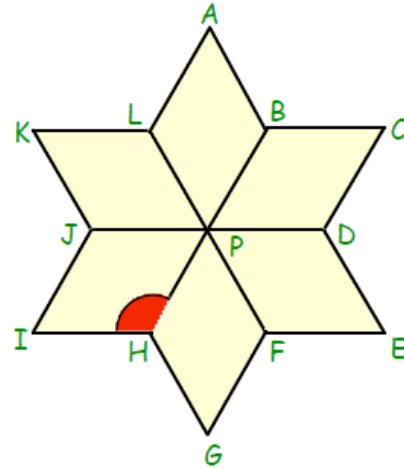
$$\angle KPN = 100^\circ$$

Sketch the rhombus and fill in the sizes of all the missing angles.

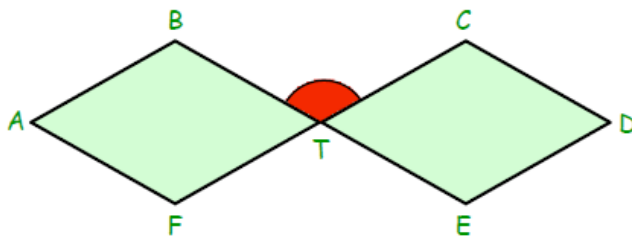


16. This figure consists of six identical rhombii around a point, P.

- a Calculate the size of one of the angles at the centre ($\angle HPJ$).
(think !!)
- b Now calculate the size of the shaded angle $\angle IHP$.



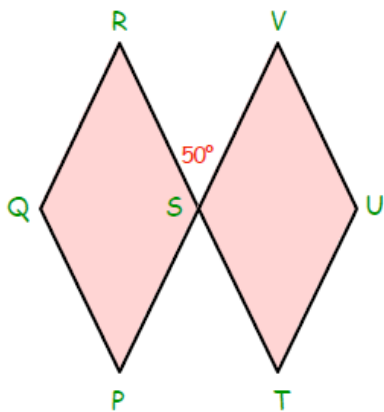
17.



2 identical rhombii are shown opposite touching at point, T.

Calculate the size of $\angle BTC$.

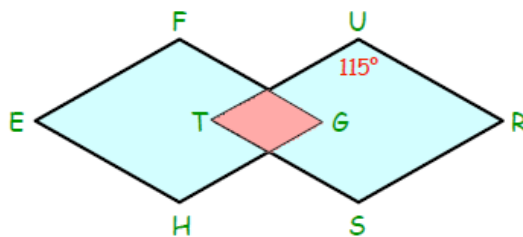
18.



Shown are 2 congruent rhombii, PQRS and STUV with angle $RSV = 50^\circ$.

Calculate the sizes of all the missing angles.

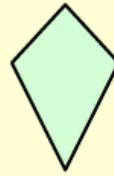
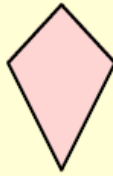
19. Two rhombii, EFGH and RSTU overlap as shown.



if angle $TUR = 115^\circ$, calculate the sizes of the four angles in the small red rhombus.

The Kite

The paper and string toy flown in the wind is named after this mathematical shape.



Exercise 5

- Use a ruler to make a neat accurate drawing of this kite.
(or trace it into your jotter).
(Start by drawing the 2 diagonals)

Answer the following questions about the kite :-

- Are all four sides the same length ?
- Are **opposite** sides the same length ?
- Are there any pairs of equal sides ?
- Are the opposite sides parallel ?
- Are all four angles the same size ?
- Are the top and bottom angles the same size ?
- Are the right and left angles the same size ?
- How many lines of symmetry has the kite ?
- Does it have $\frac{1}{2}$ turn symmetry ?
- If the kite was cut out, in how many ways could it be fitted back into the remaining hole ?

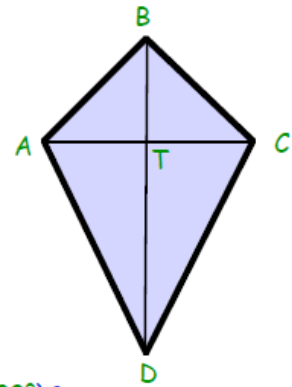
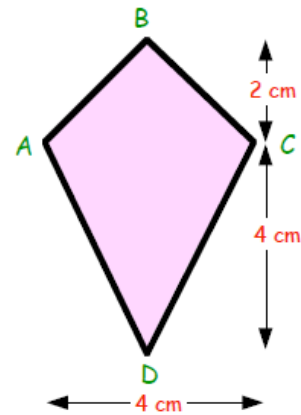
Now carefully draw the two diagonals, AC and BD meeting at the point T .

- Are the two diagonals the same length ?
- Does diagonal AC bisect BD (cut it in half) ?
- Does diagonal BD bisect AC (cut it in half) ?
- Do the two diagonals cross each other at right angles (is $\angle BTA = 90^\circ$) ?
- Does diagonal AC cut the end angles in half (is $\angle BCT = \angle DCT$) ?
- Does diagonal BD cut the end angles in half (is $\angle ABT = \angle CBT$) ?

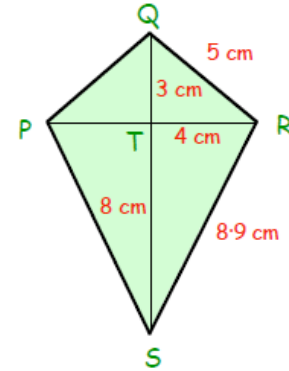
(The above are called the "**PROPERTIES**" of the kite).

- Make a list of the "**PROPERTIES**" of a kite which make it different from a square.

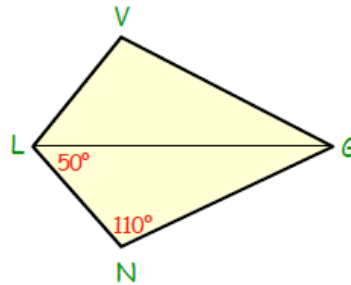
- Unlike the square, the kite does **NOT** have all its sides the same length.
- Unlike the square, its opposite sides are not parallel.
-



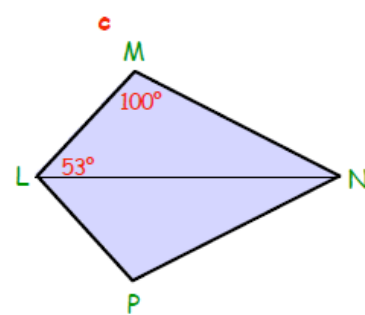
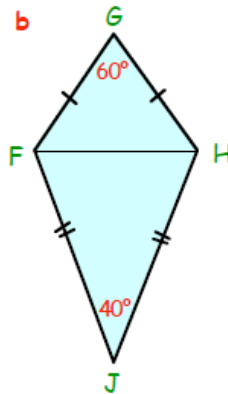
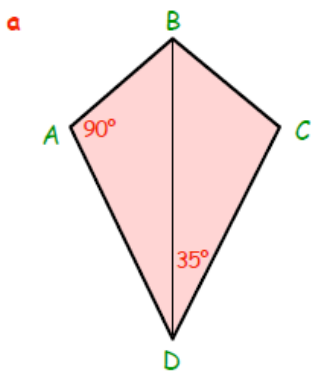
3. Look at the kite, PQRS.
What are the lengths of the 3 lines PQ, PS and PT ?



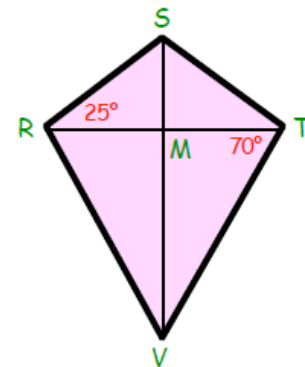
4. Look at the kite LNGV.
a Write down the size of :-
(i) $\angle LVG$ (ii) $\angle VLG$.
b Calculate the size of :-
(i) $\angle NGL$ (ii) $\angle VGL$.



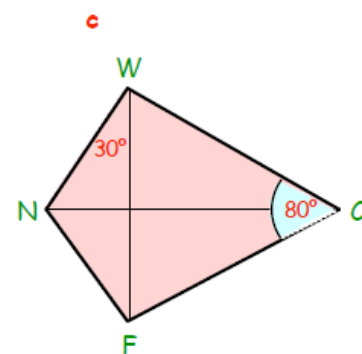
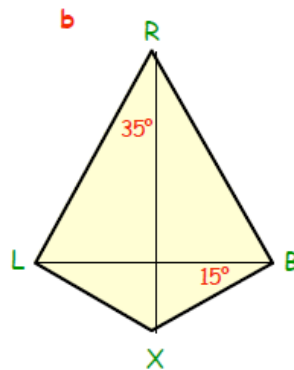
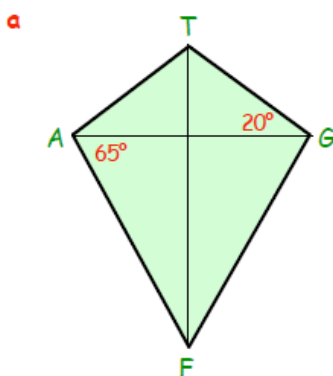
5. Make neat sketches of the following kites and calculate the sizes of all the missing angles :-



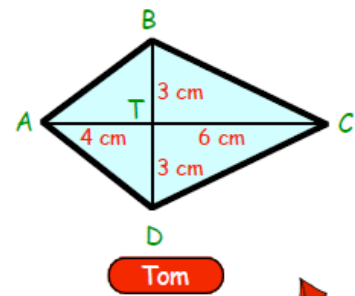
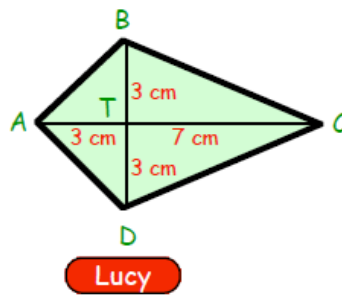
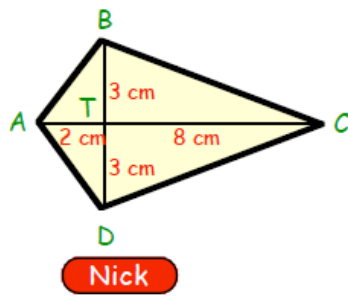
6. Look at the kite RSTV.
a Write down the size of :-
(i) $\angle STM$ (ii) $\angle MRV$ (iii) $\angle SMR$.
b Calculate the size of :-
(i) $\angle RSM$ (ii) $\angle RVM$ (iii) $\angle RVT$.



7. Make neat sketches of the following kites and calculate the sizes of all the missing angles :-



8. Nick, Lucy and Tom were asked to draw a kite which had diagonals 10 cm and 6 cm.



The above diagrams show how they drew the 3 different kites.

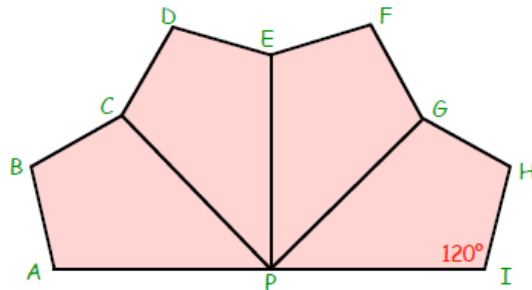
if you were asked to draw a kite like this, but with line $AT = 5$ cm, you would end up with a "special" type of kite. What type of kite would this be ?



9. This shape is made up of four identical kites.

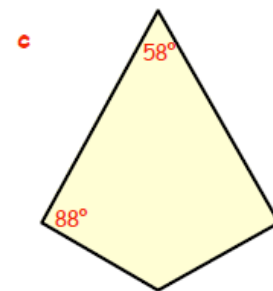
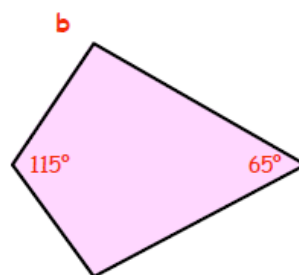
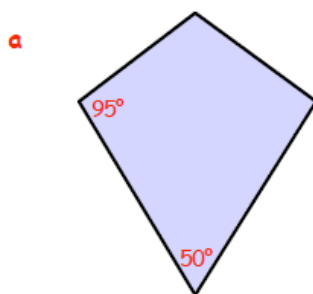
$\angle API$ is a straight angle.

- Calculate the sizes of $\angle APC$, $\angle CPE$, $\angle EPG$ and $\angle GPI$.
- Use the figure to calculate the sizes of $\angle ABC$, $\angle CDE$, $\angle EFG$ and $\angle GHI$.

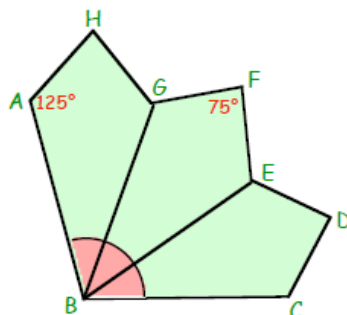


10. Calculate the sizes of the missing angles in the following kites :-

(Remember : the 4 angles of a quadrilateral ALWAYS add to)



- 11.



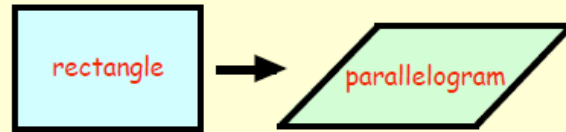
This shape consists of 3 identical kites with $\angle HAB = 125^\circ$ and $\angle GFE = 75^\circ$.

Calculate the size of obtuse $\angle ABC$.

The Parallelogram

As the name suggests, a parallelogram is a quadrilateral with both pairs of opposite sides **parallel**.

(A parallelogram is a squashed rectangle).



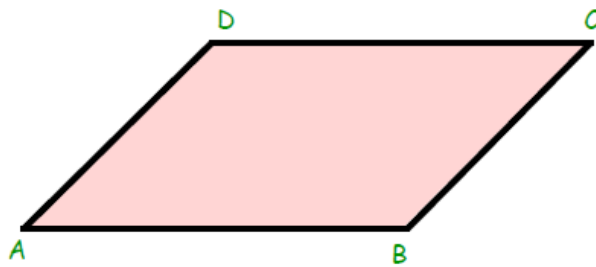
(Learn to spell parallelogram !)

Exercise 6

1. Use a ruler to make a neat drawing of a parallelogram like this. (or trace it into your jotter).

Answer the following questions about the parallelogram :-

- Are all four sides the same length ?
- Are **opposite** pairs of sides equal ?
- Are **opposite** pairs of sides parallel ?
- Are all four angles the same size ?
- Are **opposite** pairs of angles equal (i.e. $\angle DAB = \angle DCB$) ?

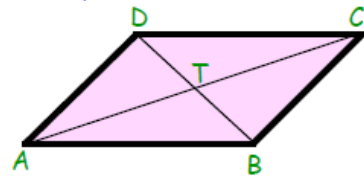


- Does it have (i) $\frac{1}{2}$ turn symmetry ? (ii) $\frac{1}{4}$ turn symmetry ?
- How many lines of symmetry does it have (Are you sure) ?
- If the parallelogram was cut out of the page, in how many ways could it be fitted back into the page ?

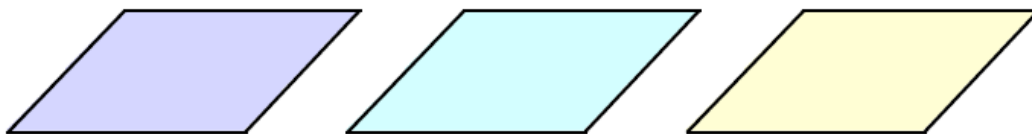
Now carefully draw the two diagonals, **AC** and **BD** meeting at **T**.

- Are the two diagonals the same length (Check by measuring) ?
- Does each diagonal bisect the other diagonal ?
- Do the diagonals meet at right angles (i.e. is $\angle DTC = 90^\circ$) ?
- Does each diagonal cut the end angle in half (i.e. is $\angle TAB = \angle TAD$) ?

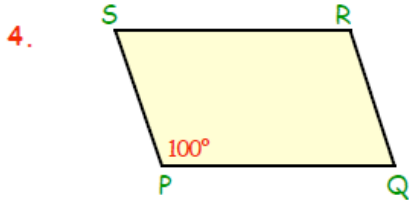
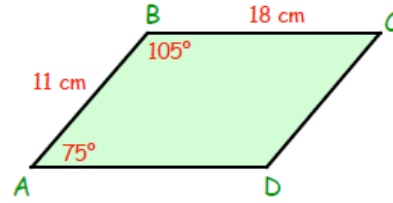
(The above are called the "**PROPERTIES**" of the parallelogram).



2. Write down "**PROPERTIES**" of a parallelogram which make it different from a rectangle.
- Unlike the rectangle, the parallelogram does **NOT** have all its angles equal.
 -



3. Sketch this parallelogram and fill in all the missing angles and sides.

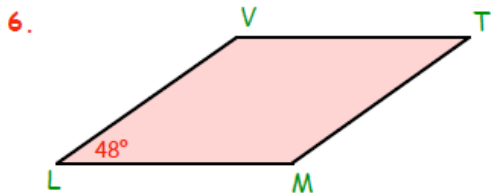
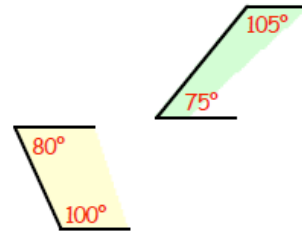


This time, you are given the size of one angle.

- a What is the size of $\angle SRQ$?
- b What must the sum of the four angles be ?
- c Calculate the sizes of $\angle PSR$ and $\angle PQR$.

5. Did you notice the following ?

- a From Question 3, what is the value of $75^\circ + 105^\circ$?
- b From Question 4, what is the value of $80^\circ + 100^\circ$?
- c What do you think will **ALWAYS** be true about the 2 **adjacent** angles in a parallelogram ?

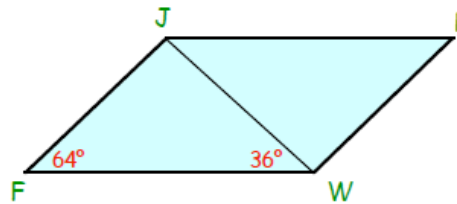


Without calculating the sizes of $\angle VTM$ and $\angle TML$, write down the size of $\angle LVT$.

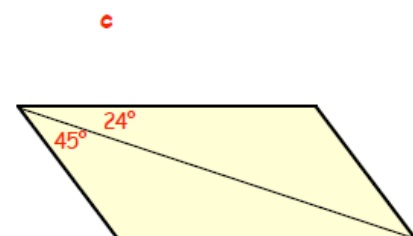
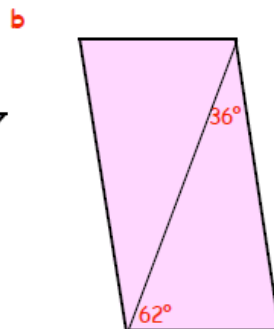
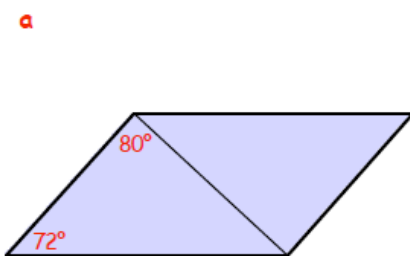
7. This time, a diagonal has been drawn.

Write down the sizes of :-

- a $\angle JPW$
- b $\angle FJW$
- c $\angle WJP$ (alternate (or z) angles ?)
- d $\angle PWJ$.

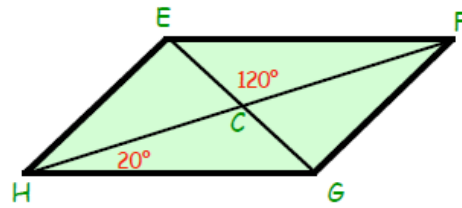


8. Make a large neat sketch of each of these parallelograms and fill in the sizes of all the missing angles :-

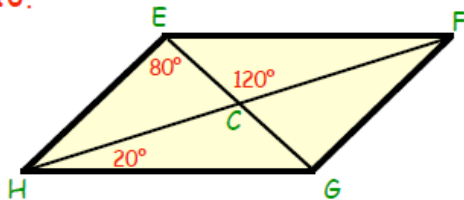


9. **Harder !!** if the 2 diagonals are drawn in, it is slightly trickier.

- Make a large neat sketch of this parallelogram.
- Fill in as many missing angles as you can.
- Can you actually calculate **ALL** the missing angles?



10.



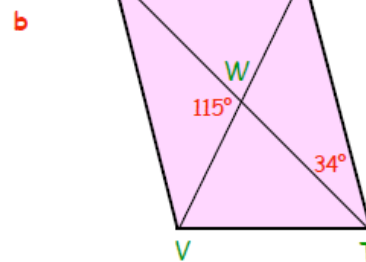
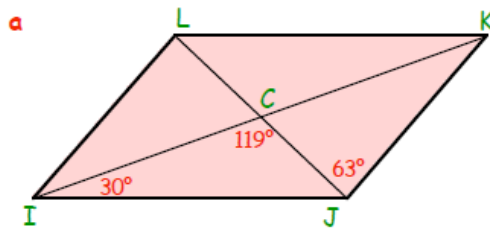
The answer to Question 9 c is "NO - not without more information".

Look at the figure now.

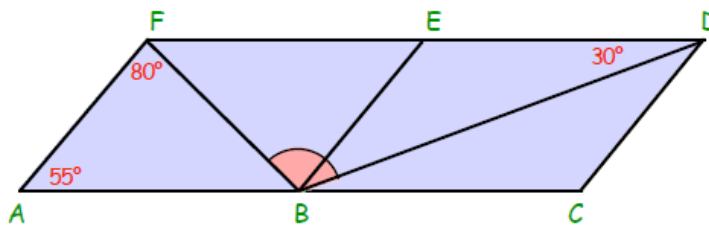
Now calculate the sizes of the angles you were unable to do in Question 9.

* You need to know 3 angles before you can calculate the sizes of the others - when both diagonals are shown.

11. Make sketches of these parallelograms and calculate the missing angles :-



12. Shown are 2 identical parallelograms, AFEB and BEDC.

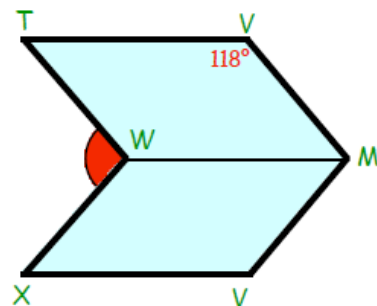


Calculate the size of the shaded angle, $\angle FBD$.

(Hint :- sketch the shape and fill in as many angles as you can)

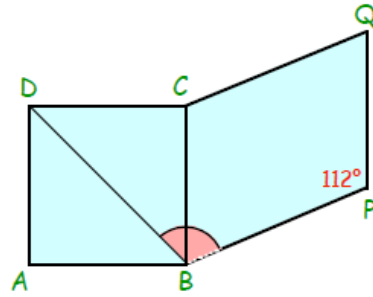
13. Again, shown are 2 identical parallelograms.

Calculate the size of obtuse $\angle TWX$.

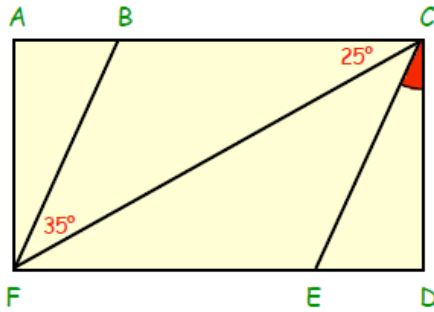


14. Shown is a square $ABCD$ and a parallelogram $BCQP$.

Calculate the size of $\angle DBP$.



15.



Parallelogram $BCEF$ is drawn inside rectangle $ACDF$.

Calculate the size of $\angle ECD$.

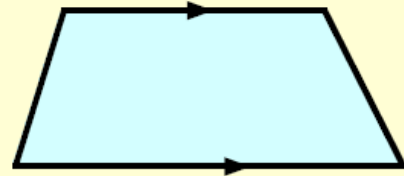
(Hint : sketch the shape and try to find as many of the missing angles as you can first)

The Trapezium

So far, you have dealt with 5 very important quadrilaterals.

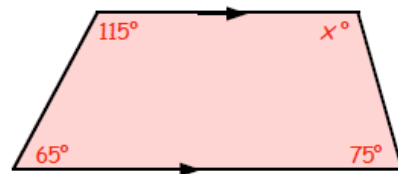
Square - Rectangle - Rhombus - Kite - Parallelogram

The quadrilateral shown opposite is called a **TRAPEZIUM**.
it has only 1 **PROPERTY** — "it has 1 pair of parallel sides".

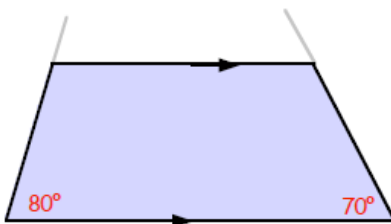


Exercise 7

1. Calculate the size of the missing angle here.



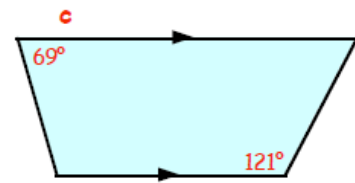
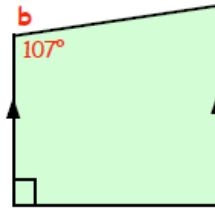
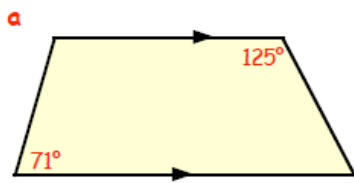
2.



You do not need to be given 3 angles in a trapezium, 2 angles are sufficient.

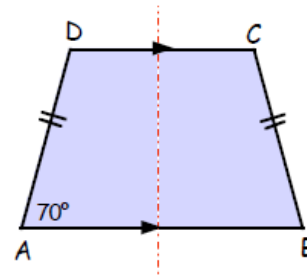
What are the sizes of the 2 missing angles here?
(hint : the grey lines should help).

3. Calculate the size of the missing angles each time here :-



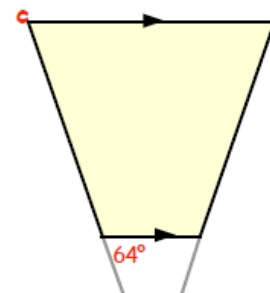
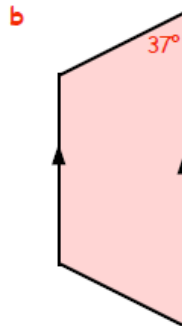
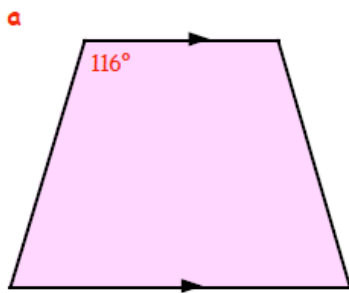
4. A "special" type of trapezium is one with 1 line of symmetry.

Sketch this trapezium and fill in the sizes of the 3 missing angles.



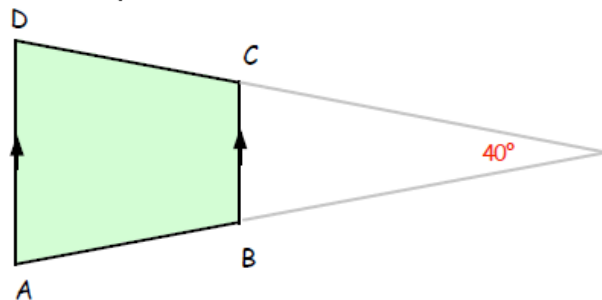
5. Each of the following are "symmetrical" **trapezia** (the plural of trapezium).

Sketch and fill in the sizes of all the missing angles :-

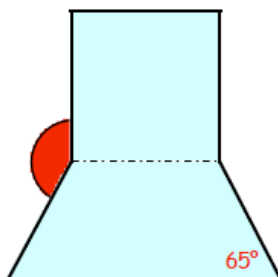


6. This trapezium is formed from an isosceles triangle.

Calculate the sizes of the four angles of trapezium ABCD.



7.



This symmetrical shape is formed from a square and a symmetrical trapezium.

Calculate the size of the shaded angle.

Organising Information

Frequency Tables

Raw data can often appear untidy and difficult to understand.

Organising such data into tables (called **frequency tables**) can make it easier to comprehend.

Exercise 2

1. A tomato grower ideally wants his tomatoes to have a diameter of 60 mm, but he is satisfied if his tomatoes have a diameter ranging from 58 mm to 62 mm.



The diameters, in millimetres, of his early crop were as follows :-

58	51	55	57	53	56	54	62	55	52	58	59
56	52	64	59	55	58	51	62	53	58	59	62
60	52	60	51	56	59	60	51	56	55	62	59
63	58	60	61	52	58	55	62	55	52	58	60

diam	tally	frequency
51		...
52		...
53
54
...

- a Organise the data into a frequency table using tally marks.
 b How many tomatoes were within the range set by the tomato grower ?
2. The table below gives the list of flowers which took first prize at the annual Abercorn Floral Show from 1982 to 2002. Some years, the judges awarded a tie between 2 particular varieties.

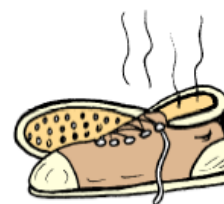


1982 Pansy	1989 Petunia	1996 Petunia & Geranium
1983 Petunia	1990 Geranium	1997 Pansy
1984 Impatiens	1991 Geranium	1998 Pansy
1985 Petunia & Impatiens	1992 Marigold	1999 Petunia
1986 Marigold	1993 Pansy	2000 Marigold
1987 Impatiens	1994 Pansy	2001 Pansy
1988 Petunia	1995 Petunia & Marigold	2002 Marigold

Make up your own frequency table to show how many times each flower has either won or shared the first prize.

3. The Primary 7's in a school recorded their shoe sizes which are shown in the table below.

2	$4\frac{1}{2}$	4	$2\frac{1}{2}$	6	$3\frac{1}{2}$	3	4	4	$3\frac{1}{2}$
4	4	$6\frac{1}{2}$	4	4	6	$3\frac{1}{2}$	4	3	$4\frac{1}{2}$
$3\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{1}{2}$	5	$3\frac{1}{2}$	5	$4\frac{1}{2}$	3	6	4
$4\frac{1}{2}$	4	5	$3\frac{1}{2}$	5	$4\frac{1}{2}$	3	$6\frac{1}{2}$	$3\frac{1}{2}$	7



- a Make a frequency table similar to the one shown opposite.
 b How many children had a shoe size **bigger** than a "5".

Shoe Size	Tally Mark	Frequency
2		
$2\frac{1}{2}$		
3		

4. Results from last year's Standard Grade History exam in Ainsworth High were :-

Class	4 H1	-	25	Grade 1's	&	5	Grade 2's
	4 H2	-	12	Grade 1's	&	7	Grade 2's
	4 H3	-	17	Grade 3's	&	2	Grade 4's
	4 H4	-	0	Grade 3's	&	5	Grade 4's
	4 H5	-	8	Grade 6's	&	4	Grade 7's

- Construct a frequency table which shows the total number of grades 1, 2, 3, 4, 5, 6 and 7's in a more organised way.
- How many grades 1 - 3 were there ?
- How many pupils sat the History exam at Ainsworth High ?

5. A batch of matchboxes is opened and the number of matches in each box is counted. the result is shown in the table below.

38	42	41	42	41	41	39	41
40	41	39	44	41	44	40	41
41	40	42	41	40	42	42	44



- Make a frequency table to show how many matches were in each box.
- How many of the sample agreed with the manufacturer's claim ?

6. The cost of a car ferry trip depends on your vehicle and when you travel. Look at these 2 tables :-

	mid night	5am	8am	noon	7pm	mid night
1 Jan - 31 May						
1 June - 31 Dec						

	Single Fare £			Weekly Return £		
Car	58	85	92	74	100	154
Lorry	88	95	97	84	113	170



- What does it cost for a single car journey at 7am on 1st March ?
- What does it cost for a weekly return for a lorry at 10am on 1st August ?
- A lorry driver pays £97 for a single journey in July.
Between which times can he use the ferry during the day ?
- A lorry driver pays £84 for a weekly return journey in November.
Between which times can he use the ferry during the day ?

Time

Exercise 1

1. **Reminder :-**

7:15 am → **0715**

3:35 pm → **1535**

Change the following 12 hour clock times to **24 hour clock times** :-

a 7:40 am

b 2:55 am

c 3 am

d 2:30 pm

e 1:15 pm

f 7 pm

g 4:45 am

h 9:20 pm

i 3:35 am

j 8:55 am

k noon

l 12:10 am

m 12:10 pm

n 8:30 pm

o 2:55 am

p 11:10 pm

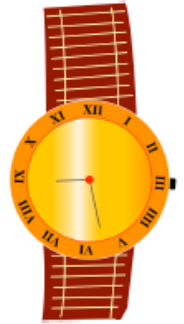
q 10:32 pm

r 6:36 am

s 11:58 pm

t 11:13 am

u 7:48 pm



2. **Reminder :-**

0615 → **6:15 am**

2015 → **8:15 pm**

Change the following 24 hour clock times to **12 hour clock times** :-

a 0230

b 1050

c 0810

d 1435

e 1650

f 2335

g 0130

h 1735

i 2010

j 1702

k 1200

l 0650

m 0345

n 1525

o 2345

p 2105

q 0040

r 0505

s 1125

t 1840

u 2248



Exercise 2

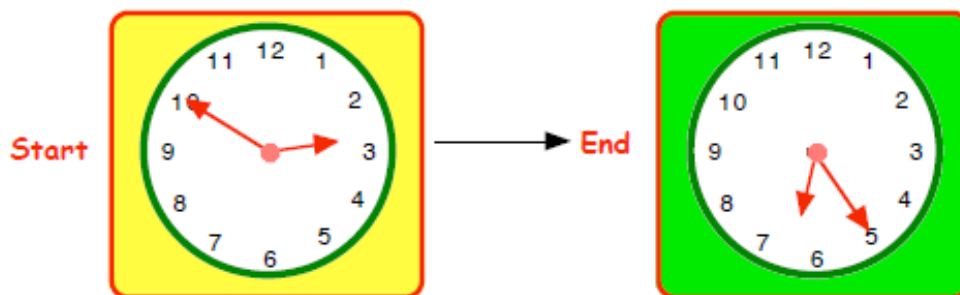
1. How long is it from :- (show how you used "counting on" to obtain your answer)

- | | | | |
|---|--------------------|---|---------------------------|
| a | 2:05 pm to 5:05 pm | b | 9 am to 11:30 am |
| c | midday to 4:30 pm | d | 7:30 pm to 10:35 pm |
| e | 6:55 am to 8:25 am | f | 3:40 am to 9:15 am |
| g | 0720 to 0925 | h | 1755 to 1920 |
| i | 1850 to 2005 | j | 2250 to 0200 (next day ?) |

2. Calculate the **finishing times** of the following concerts :-

	a	b	c	d	e
Start Time	2:30 pm	4:45 pm	7:35 pm	11:45 am	10:30 pm
Show lasted	1 hr 30 mins	2 hr 20 mins	2 hr 45 mins	55 mins	3 hr 35 mins

3. The two clocks show when a concert started and finished one Saturday afternoon.



For **how long** did the concert last ?

4. Davie set off on the Auchtermuchty Marathon at 9:35 am. He arrived, (exhausted) at the finish line at 1:12 pm. **How long** had Davie taken to run the marathon ?



5. Shown is part of the bus timetable from Slough to Plassy.

	Slough	Digby	Hove	Drail	Plassy
Early Bus	7:05 am	8:10 am	10:20 am	11:05 am	1:40 pm
Late Bus	11:15 am	12:20 am			5:50 pm

- a How long does the early bus take to travel from :-
 (i) Slough to Digby ? (ii) Hove to Drail ? (iii) Slough to Plassy ?
- b Assuming that the late bus travels at the same speed as the early bus, when would it be expected to arrive at :-
 (i) Hove ? (Hint ! Notice how long the early bus takes from Digby to Hove)
 (ii) Drail ?



- 6.



A fishing boat leaves Arbroath Harbour at 5:45 am and does not return till quarter to 5 at night. For how long had the boat been at sea ?

7. A plane leaves Heathrow Airport at 2250 on Friday. It touches down in Florida at 0435 (British time) on Saturday. How long did the flight take ?



8. A satellite circles the earth. At 0235 it is directly above Glasgow. It is then found to be above Glasgow again at 0610.

- a Calculate the time taken for 1 complete orbit of earth.
 b When would you next expect the satellite to be over Glasgow ?
 c How many **complete** orbits will it make in a day ?



- 9.



There's a bricklayer's competition to see who can build a wall made of 1000 bricks the quickest. Mick started at 0945 and completed his wall at 1405. Pat began to build his at 1250 and finished at 1705. Who was quicker and by how much ?

Calculating Time

1. Change these times into hours and minutes :-

- a $1\frac{1}{2}$ hours b $3\frac{1}{2}$ hours c $5\frac{1}{4}$ hours d $4\frac{3}{4}$ hours
e $6\frac{1}{2}$ hours f $8\frac{1}{4}$ hours g 3·5 hours h 2·5 hours
i 4·25 hours j 1·25 hours k 2·75 hours l 0·75 hours.



2. *2 hours 30 minutes is 2·5 hours, 1 hour 15 minutes is 1·25 hours*

What are these times in hours :-

- a 3 hours 30 minutes b 2 hours 15 minutes
c 5 hours 45 minutes d 1 hour 15 minutes
e 6 hours 30 minutes f 4 hours 30 minutes
g 1 hour 45 minutes h 7 hours 45 minutes ?