



Department of
Education

AUSTRALIAN CURRICULUM

MATHEMATICS YEAR 7

Triangles and quadrilateral properties

MATHEMATICS

YEAR 7

Triangles and quadrilateral properties

Student's name: _____

Teacher's name: _____

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Signposts

Each symbol is a sign to help you.

Here is what each one means:



The recommended time you should take to complete this section.



An explanation of key terms, concepts or processes.



A written response.
Write your answer or response in your journal.



Correct this task using the answers at the end of the resource.



Calculators may not be used here.



Make notes describing how you attempted to solve the problem. Keep these notes to refer to when completing the Self-evaluation task. Your teacher may wish you to forward these notes.

Introduction

This resource should take you approximately two weeks to complete. It comprises seven learning sections, a summary section and a review task section.

The learning sections have the following headings:

- **Key words**
These are the main words that you need to understand and use fluently to explain your thinking.
- **Warm-up**
Warm-up tasks should take you no longer than 10 minutes to complete. These are skills from previous work you are expected to recall from memory, or mental calculations that you are expected to perform quickly and accurately. If you have any difficulties in answering these questions, please discuss them with your teacher.
- **Review**
Some sections have reviews immediately after the warm-up. The skills in these reviews are from previous work and are essential for that section. You will use these to develop new skills in mathematics. Please speak to your teacher immediately if you are having any trouble in completing these activities.
- **Focus problem**
Focus problems are designed to introduce new concepts. They provide examples of the types of problems you will be able to solve by learning the new concepts in this resource. Do not spend too long on these but do check and read the solutions thoroughly.
- **Skills development**
These help you consolidate new work and concepts. Most sections include skills development activities which provide opportunities for you to become skilled at using new procedures, apply your learning to solve problems and justify your ideas. Please mark your work after completing each part.

Correcting your work

Please mark and correct your work as you go. Worked solutions are provided to show how you should set out your work. If you are having any difficulty in understanding them, or are getting the majority of the questions wrong, please speak to your teacher immediately.

Journal

Please keep an exercise book to record your notes and to summarise your learning. At the end of each section, write definitions for the key words that were introduced for that section.

Curriculum details

Content Descriptions

This resource provides learning and teaching to deliver the Australian Curriculum: Mathematics for the following Year 7 Content Descriptions.

Demonstrate that the angle sum of a triangle is 180° and use this to find the angle sum of a quadrilateral (ACMMG166)

Classify triangles according to their side and angle properties and describe quadrilaterals (ACMMG165)

Content Descriptions	1	2	3	4	5	6	7	R
ACMMG166								
ACMMG165								



Indicates the content description is explicitly covered in that section of the resource.

Previous relevant Content Descriptions

The following Content Descriptions should be considered as prior learning for students using this resource.

At Year 6 level

Investigate, with and without digital technologies, angles on a straight line, angles at a point and vertically opposite angles. Use results to find unknown angles (ACMMG141)

Proficiency strand statements at Year 7 level

At this year level:

Understanding includes describing patterns in uses of indices with whole numbers, recognising equivalences between fractions, decimals, percentages and ratios, plotting points on the Cartesian plane, identifying angles formed by a transversal crossing a pair of lines, and connecting the laws and properties of numbers to algebraic terms and expressions

Fluency includes calculating accurately with integers, representing fractions and decimals in various ways, investigating best buys, finding measures of central tendency and calculating areas of shapes and volumes of prisms

Problem Solving includes formulating and solving authentic problems using numbers and measurements, working with transformations and identifying symmetry, calculating angles and interpreting sets of data collected through chance experiments

Reasoning includes applying the number laws to calculations, applying known geometric facts to draw conclusions about shapes, applying an understanding of ratio and interpreting data displays

General capabilities

General capabilities	1	2	3	4	5	6	7	R
Literacy								
Numeracy								
Information and communication technology (ICT) capability								
Critical and creative thinking								
Personal and social capability								
Ethical behaviour								
Intercultural understanding								



Indicates general capabilities are explicitly covered in that section of the resource.

Cross-curriculum priorities

Cross-curriculum priorities	1	2	3	4	5	6	7	R
Aboriginal and Torres Strait Islander histories and cultures								
Asia and Australia's engagement with Asia								
Sustainability								



Indicates cross-curriculum priorities are explicitly covered in that section of the resource.

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1. Reviewing angles

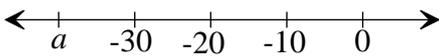
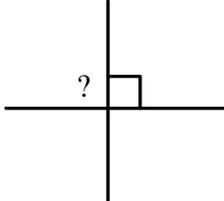
When you complete this section you should be able to:

- measure and classify angles.

Key words

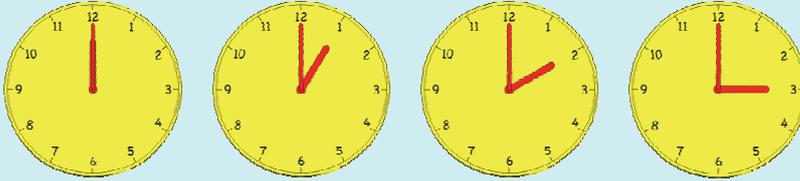
- acute angle
- right angle
- obtuse angle
- straight angle
- reflex angle
- revolution angle

Warm-up 1

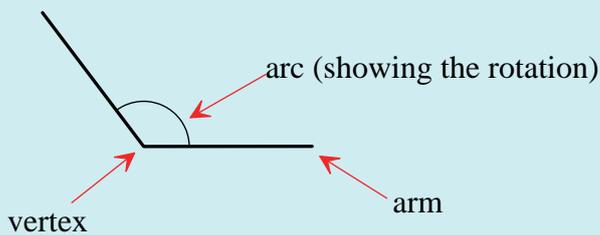
- List the factors of 8. _____
- $8 + 8 =$ _____
- What is the missing number?
 $a =$ _____

- Circle the greater fraction. $\frac{3}{4}$ or $\frac{7}{10}$
- Find two-halves of 6. _____
- $18 - 5.2 =$ _____
- $3.6 \times 9 =$ _____
- Write 0.166... as a fraction.
- Complete: 23, 27, 31, _____
- Determine the size of the missing angle.


Review 1.1

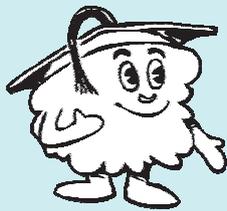
An angle is the measure of turn or rotation. For example, the following shows the angle between the two hands of a clock increasing in size from left to right.



Angles can be represented using diagrams like the one that follows.



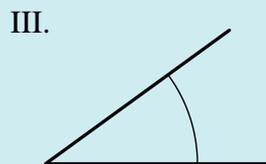
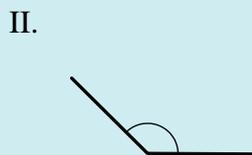
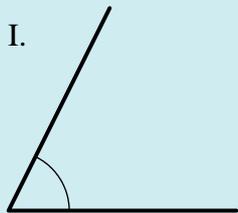
The size of an angle is not determined by the size of its diagram. Just because the arms of the angle or the arc marking the angle is large does not mean the angle is large.



Remember, an angle's size is a measure of rotation.

Example

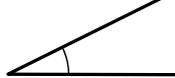
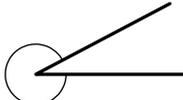
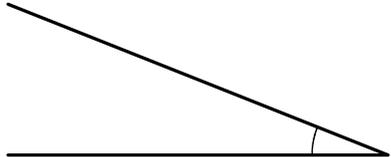
Place the angles in order of size from smallest to largest.



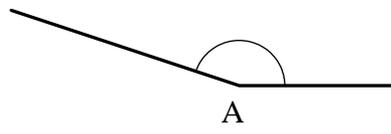
Solution

From smallest to largest the angles are: III, I and II.

1. For each of the following pairs of angles, tick the larger angle.

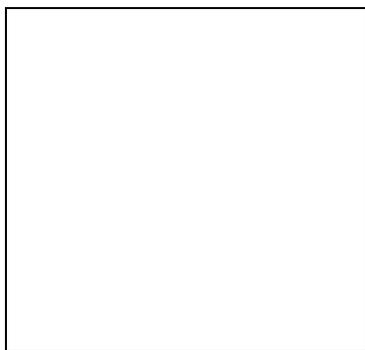
(a) 	
(b) 	
(c) 	

2. The following represents angle A.



In the space below, draw an angle:

(a) smaller than angle A

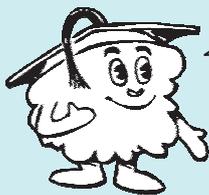
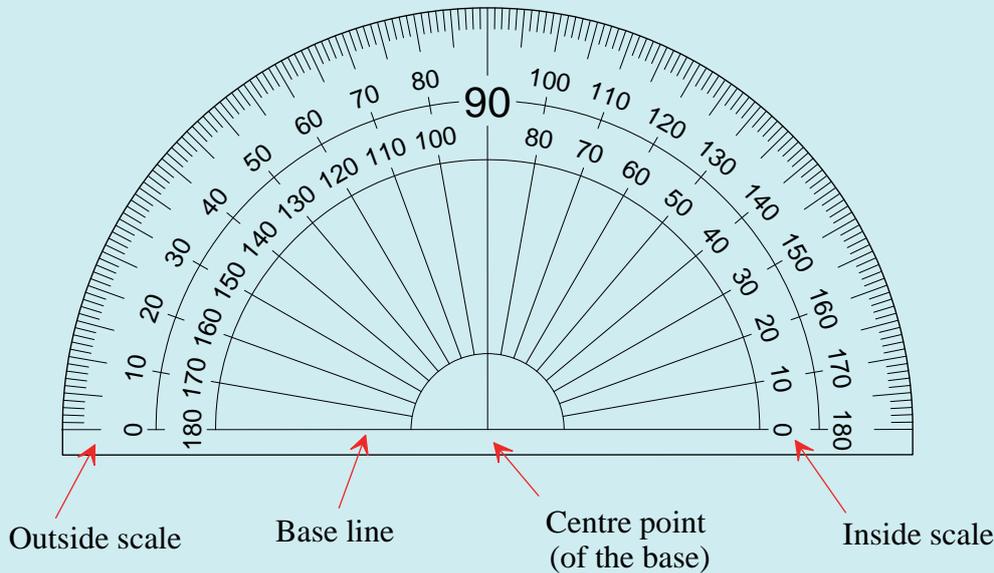


(b) larger than angle A.



Review 1.2

A protractor can be used to measure the amount of rotation.



Note how there are two scales on the protractor, an inside and an outside scale. The scale that you use depends on how you line your protractor up against your angle.

To correctly measure angles using a protractor, follow these steps.

1. Place the centre point of the base of the protractor on the vertex of the angle.
2. Rotate the protractor so that its base line is on one of the arms of the angle. Make sure the protractor is covering the angle. If it is not, then rotate the protractor until it does. (If you move the protractor, make sure the centre point is still on the vertex.)
3. Read the size from the protractor from where the angle's second arm points to the scale. Make sure you read from the correct scale. When choosing the scale, you should remember that you are measuring the size of the rotation, which starts from zero degrees (and not 180°).

Example

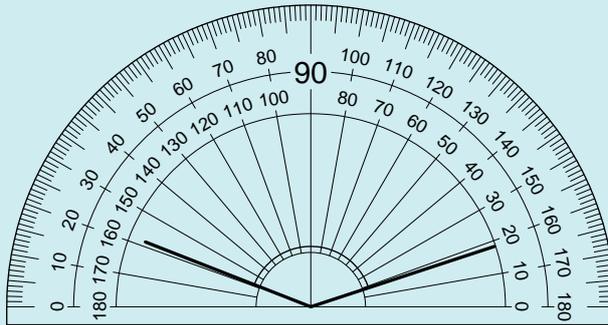
Measure the following angle.



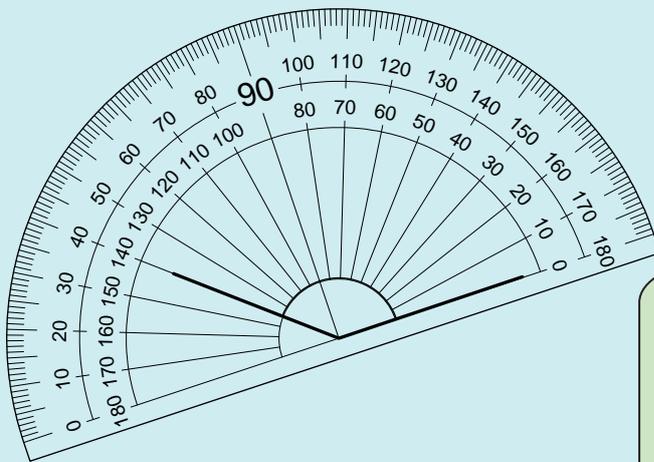
Note how this angle has arrows. These arrows are often omitted for convenience.

Solution

Step 1 – Place the centre point of the base of the protractor on the vertex of the angle.

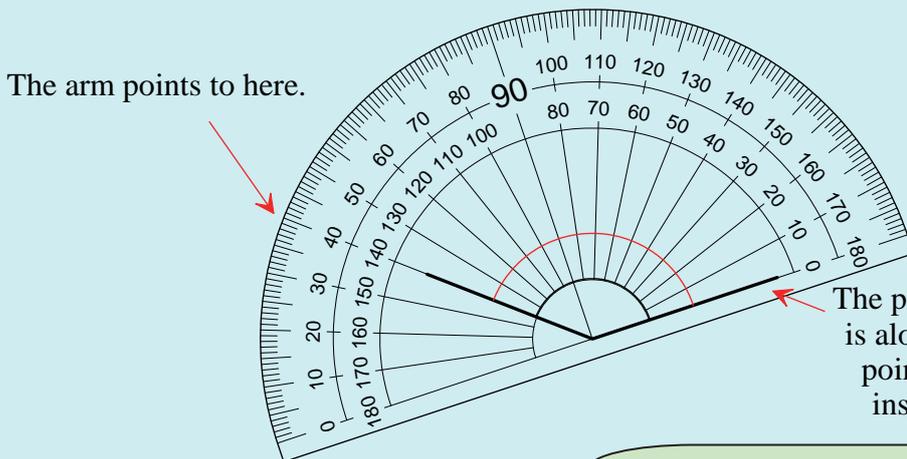


Step 2 – Rotate the protractor so that its base line is on top of one of the arms of the angle.



Note that you can place the base line of the protractor on either arm as long as it covers the angle. You should get the same result.

Step 3 – Read the size of the angle from the correct scale. (Remember to start from zero.)



Sometimes you might have to extend the angle's arms so that you can position and read from the protractor correctly.

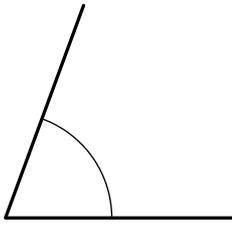


The size of the angle is 140° .

Also, note how the degree sign is used.

1. Estimate the size of each of the angles shown below then measure the size correct to the nearest degree.

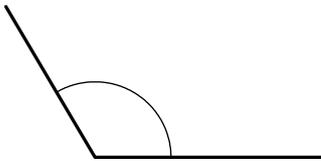
(a)



Estimate: _____

Measured size: _____

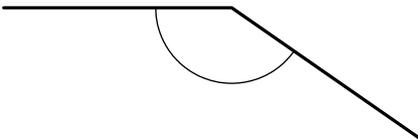
(b)



Estimate: _____

Measured size: _____

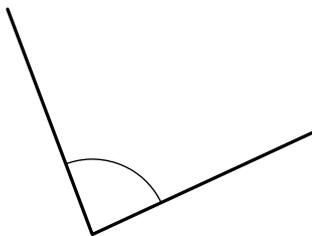
(c)



Estimate: _____

Measured size: _____

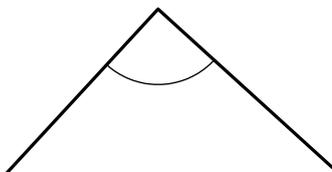
(d)



Estimate: _____

Measured size: _____

(e)



Estimate: _____

Measured size: _____

Review 1.3

Angles are measured in degrees and can be classified according to their size.

- An **acute angle** is between 0° and 90° .
- A **right angle** is exactly 90° .
- An **obtuse angle** is between 90° and 180° .
- A **straight angle** is exactly 180° .
- A **reflex angle** is between 180° and 360° .
- A **revolution** is exactly 360° .

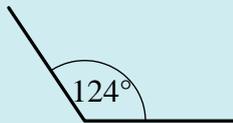


Note how the degree sign is used.

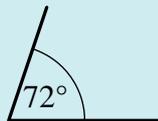
Example

Classify the following angles as either acute, obtuse, right, straight, reflex, or revolution.

(a)



(b)



(c)



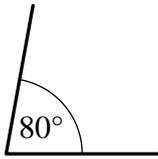
Solution

- (a) It is an obtuse angle as it is between 90° and 180° .
- (b) It is an acute angle as it falls between 0° and 90° .
- (c) It is a right angle. Although it does not show its measurement, it is exactly 90° . This is known because of its special marking.

- A _____ angle is exactly 180° .
 - An _____ angle is between 90° and 180° .
 - A _____ angle is exactly 90° .
 - A _____ angle is an angle that is greater than 180° but less than 360° .
 - A _____ is an angle that is 360° .
 - An _____ angle is between zero degrees and 90 degrees.

2. Classify each of the following angles as either **acute**, **obtuse**, **right**, **straight**, **reflex**, or **revolution**.

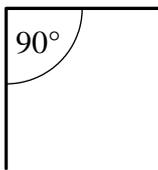
(a)



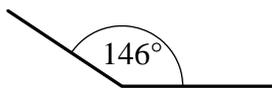
(b)



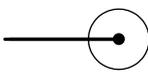
(c)



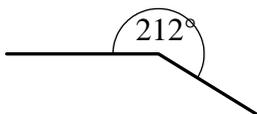
(d)



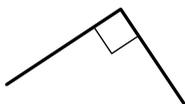
(e)



(f)



(g)



Check your work before continuing.

2. Investigating triangles

When you complete this section you should be able to:

- demonstrate that the angle sum of a triangle is 180° .

Warm-up 2

1. Circle the greatest common factor of 18 and 24.

2, 4, 6, 8, 10

2. $13 - 6 =$ _____

3. The temperature was 7 degrees but it dropped 9 degrees.

What is the new temperature? _____

4. Insert $<$, $>$ or $=$ to make the following sentence true.

$$\frac{5}{6} \square \frac{3}{3}$$

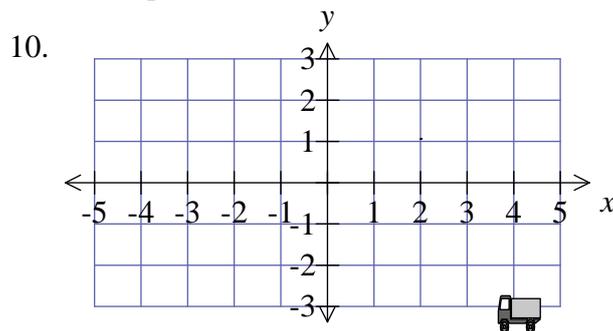
5. $\frac{3}{2} \times 10 =$ _____

6. Round 4.29 to a whole number. _____

7. $3 \overline{)0.213}$

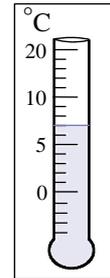
8. Write 53% as a decimal. _____

9. Complete: 9.7, 10.1, 10.5, _____



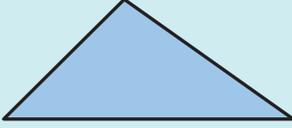
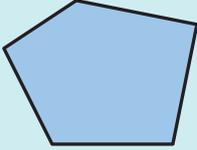
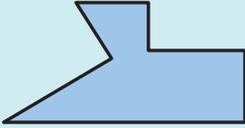
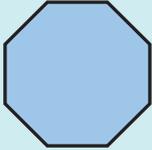
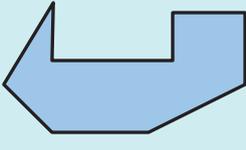
The truck is shown at (4, -3).

If the truck moves 2 units left,
where will it then be?



Review 2

A polygon is a plane shape bounded by joining line segments. They can be classified according to the number of these segments, or sides, as shown below.

Number of sides	Name	Example
3	Triangle	
4	Quadrilateral	
5	Pentagon	
6	Hexagon	
7	Septagon/heptagon	
8	Octagon	
9	Nonagon	
10	Decagon	

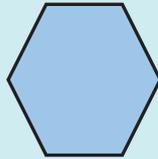
Example

Classify the following polygons according to their number of sides.

(a)



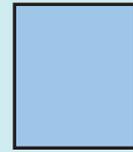
(b)



(c)



(d)

**Solution**

(a) Pentagon (5 sides)

(b) Hexagon (6 sides)

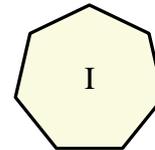
(c) Triangle (3 sides)

(d) Quadrilateral (4 sides)

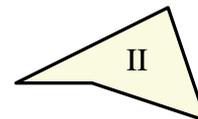
1. What is the name for an eight-sided polygon? _____

2. Match the name with the shape.

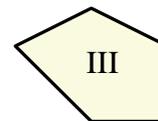
A. Quadrilateral



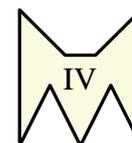
B. Nonagon



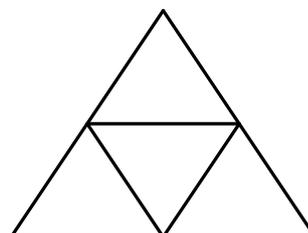
C. Heptagon



D. Pentagon

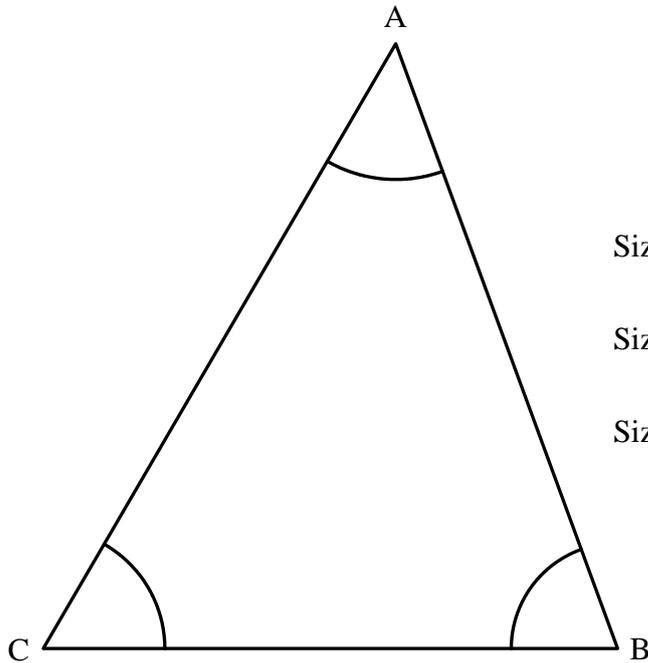


2. How many triangles are in the following shape?



Investigation 2 – Angles in a triangle

1. Use a protractor to measure the angles A, B and C.

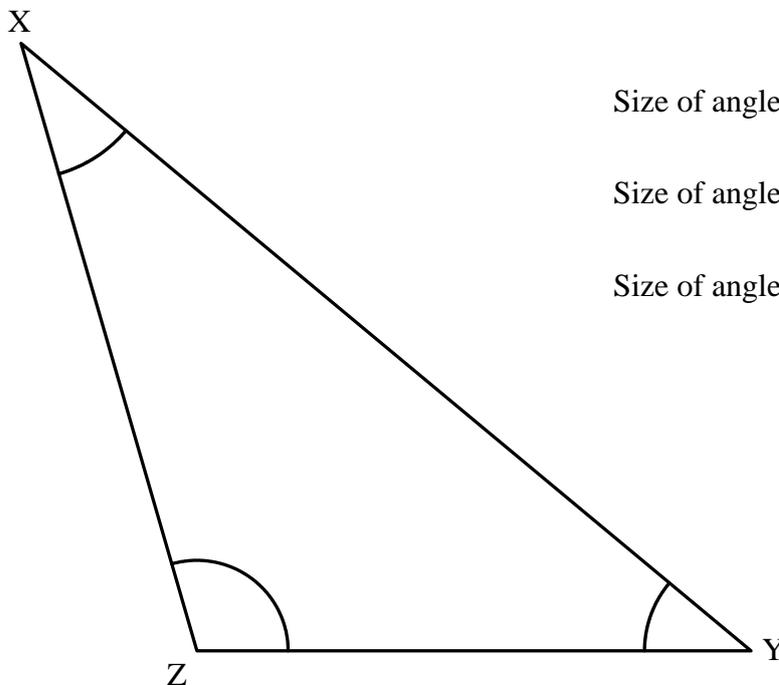


Size of angle A: _____

Size of angle B: _____

Size of angle C: _____

2. Add the sizes of the angles A, B and C together and record your answer. _____
3. Use a protractor to measure angles X, Y and Z.



Size of angle X: _____

Size of angle Y: _____

Size of angle Z: _____

4. Add the sizes of angles X, Y and Z together and record your answer. _____

5. Draw any type of triangle in the space below.

6. Measure each of the three angles inside your triangle.

7. Add the sizes of the three angles together. Record the total. _____

8. Compare your answers for questions 2, 4 and 7. Comment on what you find.

9. Describe any possible errors that could affect your results, even if you did not make them.

If possible, compare your results with another student or ask your teacher to check your work.

The sum of the interior angles of a triangle is 180° .



10. Using your own words, explain what the statement above means.

11. (a) Do you agree with the statement above? _____

(b) Give your reason. _____



Make notes describing how you completed the investigation. Keep these notes to refer to when completing the Self-evaluation task. Your teacher may wish you to forward these notes.

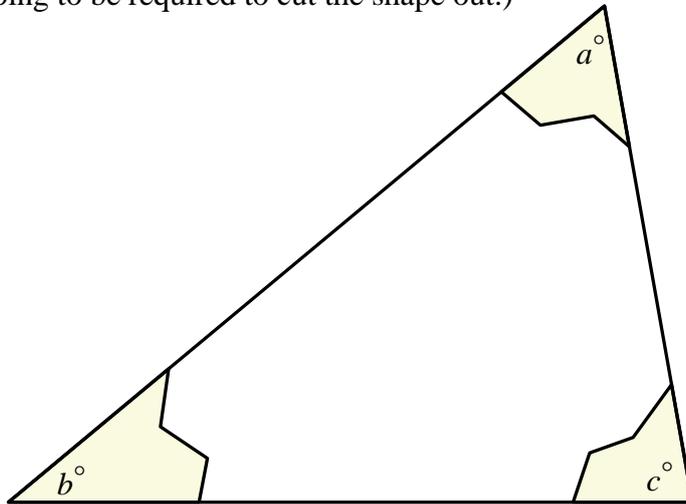


Check your work before continuing.

Activity 2 – Angles in a triangle

Angles in a straight line add to 180° . In this activity, we are going to use this to show that the interior angles in a triangle add to 180° .

- Trace the following triangle onto a piece of paper that you can cut. (You are eventually going to be required to cut the shape out.)



- Measure each of the interior angles in the triangle.

$$a^\circ = \underline{\hspace{2cm}}^\circ$$

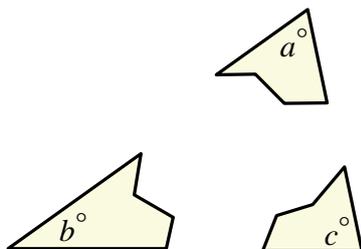
$$b^\circ = \underline{\hspace{2cm}}^\circ$$

$$c^\circ = \underline{\hspace{2cm}}^\circ$$

- Add them together and check that they total 180° .

$$a + b + c = \underline{\hspace{2cm}}$$

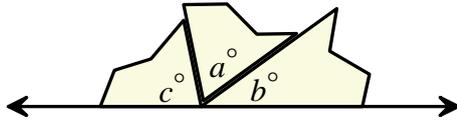
- Now cut out the triangle and then tear off each corner. (We are only interested in keeping the corners as they contain the angles that we require.)



So that you can follow the next step correctly, you may like to mark the corners with a pen.



5. On the line below, place your three corners as shown in the following diagram. (It does not matter in what order you place them as long as they fit onto the line.)



6. Do your angles line up along the straight line? _____
7. What can you deduce about the sum of the interior angles of a triangle from question 6? Give your reasoning.
- _____
- _____
8. Will this happen with a different triangle? _____
9. Draw another triangle of your own, tear off the corners and as before, glue them along the following line.



Check your work before continuing.

3. Classifying triangles

When you complete this section you should be able to:

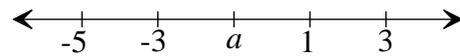
- classify triangles according to their angle and side properties.

Warm-up 3

1. Circle the primes. 4, 7, 11, 15

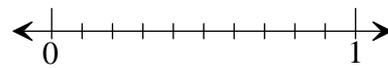
2. $8 \times 8 =$ _____

3. What is the missing number?



$a =$ _____

4. Locate $\frac{2}{3}$ on the number line.



5. Find three-quarters of 16. _____

6. Estimate the sum by first rounding to whole numbers

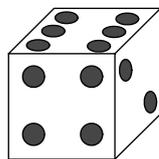
$$24.9 + 9.1 \approx \text{_____}$$

7.
$$\begin{array}{r} 5.2 \\ \times 5 \\ \hline \end{array}$$

8. Write $\frac{3}{8}$ as a percentage. _____

9. Complete: $\frac{7}{4}$, 2, $\frac{9}{4}$, _____

10. A six-sided die is rolled.

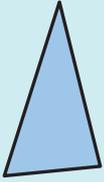


Express, as a decimal, the probability that it lands on a number that is a factor of six.

Review 3

A triangle is a three-sided polygon. It has three angles inside the shape.

The following is an example of a triangle.



The word triangle is made up of the prefix 'tri' and the word 'angle'. The prefix 'tri' is from Greek and Latin origins and means three.

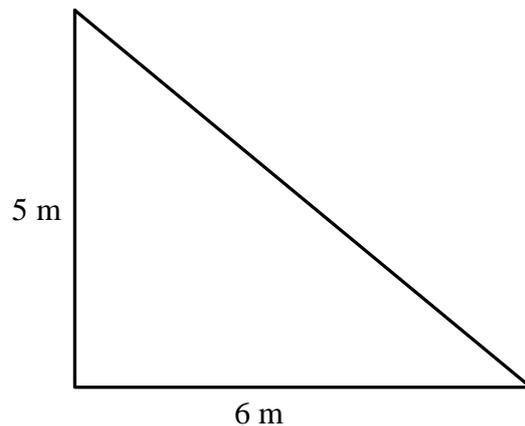
1. (a) How many sides does a triangle have? _____
- (b) How many angles does a triangle have? _____
- (c) List three words that have the prefix 'tri'. Give a brief definition of each word listed. (Note that some words start with tri without it being a prefix, such as trial.)

2. Can a triangle have an angle greater than 180° ? Give your reasoning.

Focus problem 3

Martin was working for the local hardware store when someone called him on the telephone and asked him to cut out a piece of plywood in the shape of a triangle. They wanted the base to measure 6 m and the length of another side to be 5 metres.

Martin took down the measurements and then later created a triangle. The following is a scale drawing of the triangle with 1 cm representing 1 m.



Afterwards, Martin realised that he could have created a different triangle.

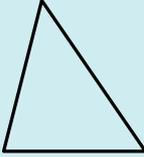
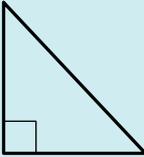
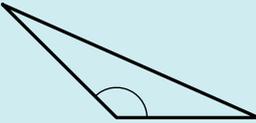
In the space below, draw a triangle that is different to the one above but still has two sides with measurements of 6 cm and 5 cm.



Check your work before continuing.

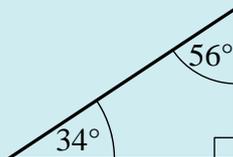
Skills development 3.1

Triangles can be classified according to the sizes of their angles.

Size of angles	Name	Example
Three acute angles	Acute-angled triangle	
One angle 90°	Right-angled triangle	
One angle greater than 90°	Obtuse-angled triangle	

Example

Classify the following triangle using its angle properties.



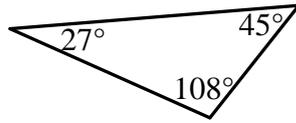
Solution

It is a right-angled triangle. It has one angle that is 90° (which is represented by the square).

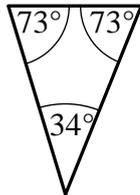
1. Complete the following.
 - (a) An a _____-angled triangle has all three angles less than 90° .
 - (b) An o _____-angled triangle has one angle greater than 90° .
 - (c) A r _____-angled triangle has one angle of 90° .

2. Classify the following triangles using their angle properties.

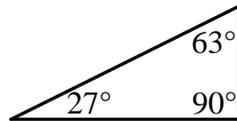
(a)



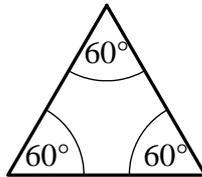
(b)



(c)



(d)



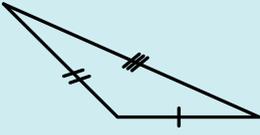
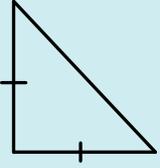
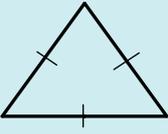
3. Explain why a triangle cannot have two obtuse angles.



Check your work before continuing.

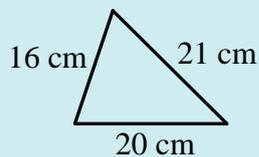
Skills development 3.2

Triangles can be classified according to their side lengths.

Side lengths	Name	Example
No sides equal	Scalene triangle	
Two sides equal	Isosceles triangle	
All sides equal	Equilateral triangle	

Example

Classify the following triangle according to its side properties.



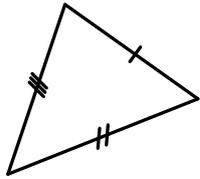
Solution

It is a scalene triangle. All the sides are different in length.

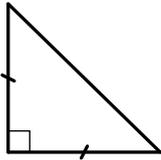
- Complete the following.
 - An e_____ triangle has all sides the same length.
 - An i_____ triangle has two sides of the same length.
 - A s_____ triangle has no sides the same length.

2. Classify the following triangles using their side properties.

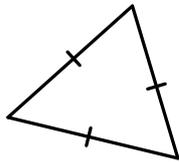
(a)



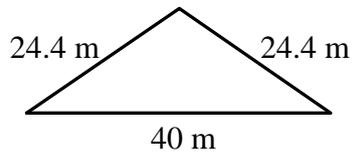
(b)



(c)



(d)



3. Explain why an equilateral triangle cannot have an obtuse angle.



Check your work before continuing.

4. Using triangle properties

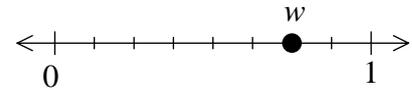
When you complete this section you should be able to:

- use triangle properties to find unknown angles and sides.

Warm-up 4

1. Which number is the odd one out? 3, 5, 7, 9, 11
2. $81 \div 9 =$ _____
3. The temperature was minus 3 degrees but it went up 7 degrees.
What is the new temperature? _____

4. Express the value of w as a fraction. _____



5. $\frac{2}{3} \times 24 =$ _____

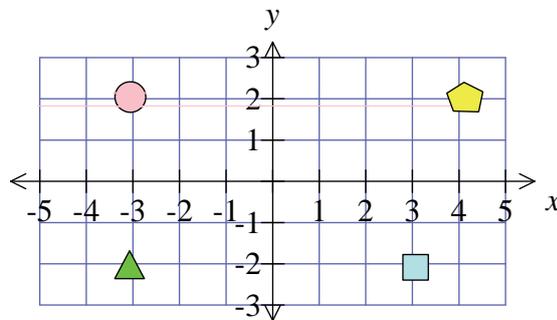
6. $500.1 \div 1000 =$ _____

7. $8.32 \div 2 =$ _____

8. Write 125% as fraction. _____

9. Complete: 87, 80, 73, _____

- 10.

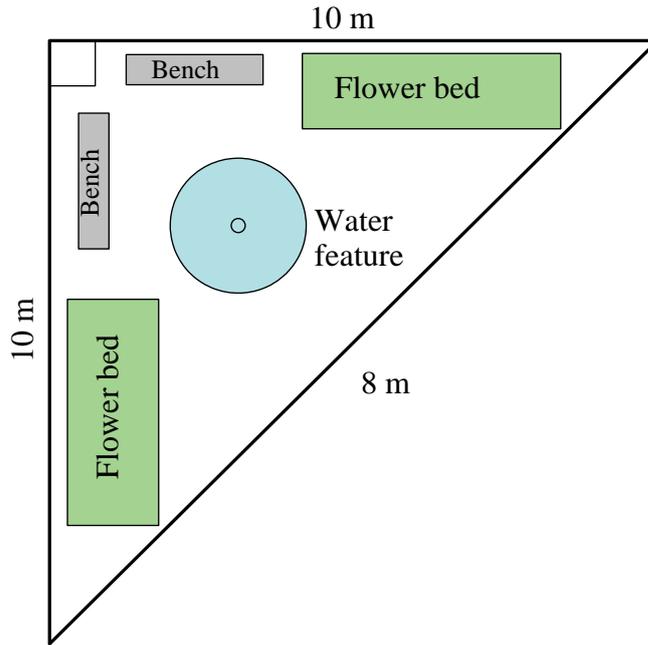


Which shape is at $(-3, -2)$?

Focus problem 4

Rennie drew up the new quadrangle garden design, as shown at right.

Martin looked at the design and said that she must have made a mistake in the measuring of the sides and told her to recheck her numbers.



Examine the triangle to determine the mistake. (You may like to attempt to draw it below using centimetres instead of metres.)



Check your work before continuing.

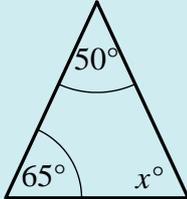
Skills development 4

Missing angles and sides can be determined by using your knowledge about triangles and their properties.

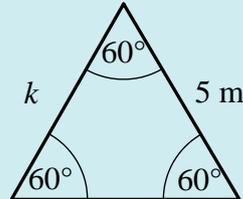
Example

Determine the unknown for each of the following.

(a)



(b)



Solution

(a) The sum of the interior angles in a triangle is 180° .

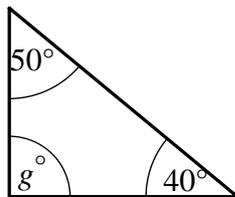
$$\begin{aligned} x &= 180 - 50 - 65 \\ &= 65 \end{aligned}$$

Therefore, the unknown angle is 65° , which makes this an isosceles triangle.

(b) The triangle is an equilateral triangle. All angles are the same size and all sides have the same length. Therefore, the unknown side is 5 m.

- The sum of the three angles in a triangle is _____ degrees.
- Determine the unknown for each of the following and give your reasoning.

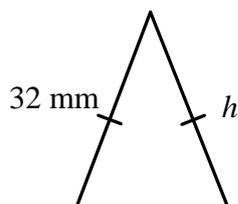
(a)



$$g = \underline{\hspace{2cm}}$$

Reason: _____

(b)

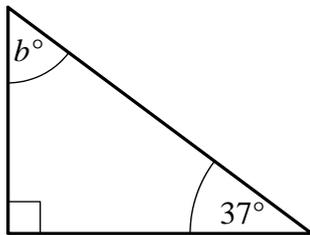


$$h = \underline{\hspace{2cm}}$$

Reason: _____

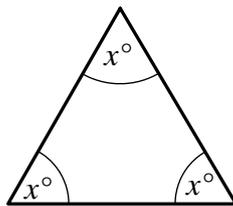
3. Determine the unknown for each of the following.

(a)



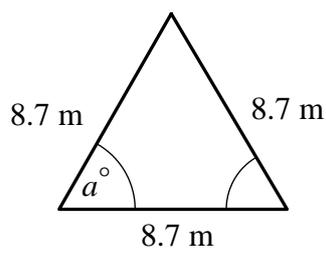
$b =$ _____

(b)



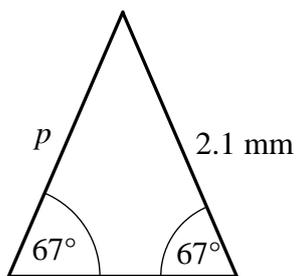
$x =$ _____

(c)



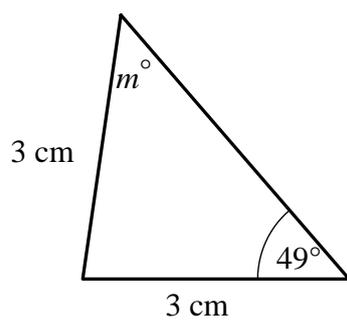
$a =$ _____

(d)



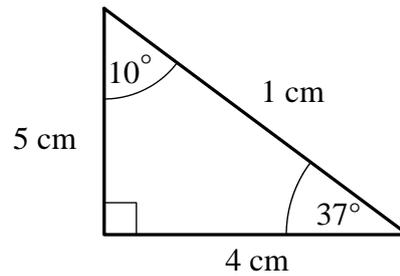
$p =$ _____

(e)



$m =$ _____

4. Explain why this triangle cannot exist, given the sizes of its angles and sides.



5. Use your knowledge about triangles to complete the table.

Name	Side properties	Angle properties
	All sides are different lengths	
		All angles equal in size
Right-angled		
	Sides can either be different lengths or two sides the same length or all the same length	All angles are less than 90°
Isosceles		Two angles must be the same size
Obtuse-angled	Sides can either be different lengths or two sides can be the same length	



Check your work before continuing.

5. Investigating quadrilaterals

When you complete this section you should be able to:

- demonstrate that the angle sum of a quadrilateral is 360° .

Key words

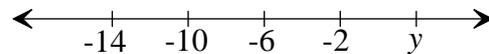
- quadrilateral

Warm-up 5

1. Express 12 as factors of primes. $2 \times 2 \times$ _____

2. $525 + 8 =$ _____

3. What is the missing number?



$y =$ _____

4. $\frac{1}{3} + \frac{2}{3} =$ _____

5. Find two-quarters of 40. _____

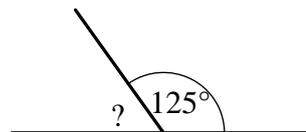
6. $0.2 \text{ mm} =$ _____ cm

7. $4 + 2 \times 9 =$ _____

8. Write $2\frac{1}{4}$ as decimal. _____

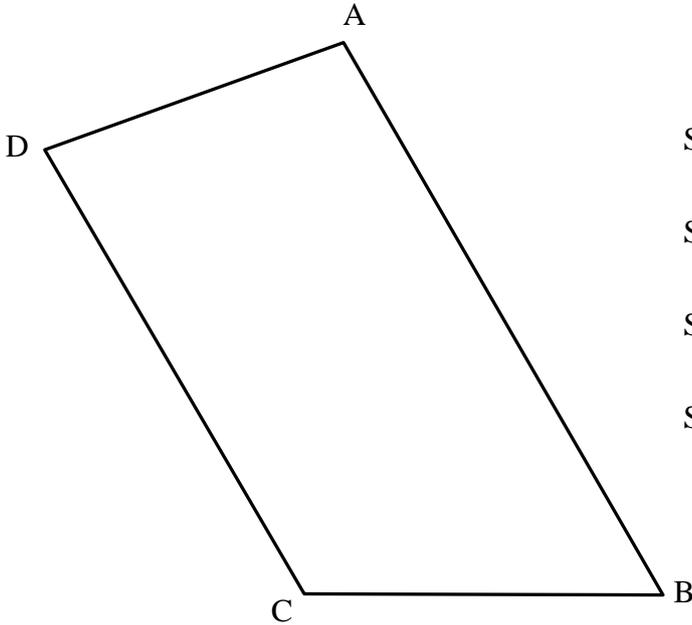
9. Complete: 0.18, 0.15, 0.12, _____

10. Determine the size of the missing angle.



Investigation – Angles in a quadrilateral

- Use a protractor to measure the inside (or interior) angles A, B, C and D.



Size of angle A: _____

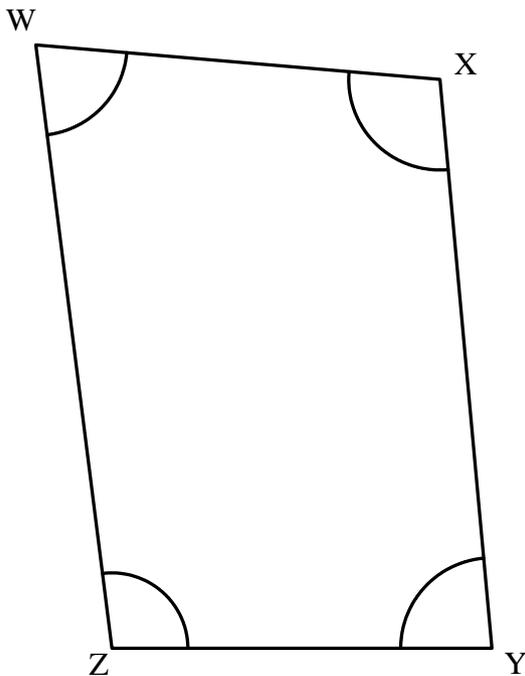
Size of angle B: _____

Size of angle C: _____

Size of angle D: _____

- Add the sizes of the angles A, B, C and D together and record your answer. _____

- Use a protractor to measure angles W, X, Y and Z.



Size of angle W: _____

Size of angle X: _____

Size of angle Y: _____

Size of angle Z: _____

- Add the sizes of angles W, X, Y and Z together and record your answer. _____

5. Draw any type of **quadrilateral** in the space below. (Use a ruler or a drawing template.)

6. Measure each of the four angles inside your quadrilateral.

7. Add the sizes of the four angles together. Record the total. _____

8. Compare your answers for questions 2, 4 and 7. Comment on what you find.

9. Describe any possible errors that could affect your results, even if you did not make them.

If possible, compare your results with another student or ask your teacher to check your work.

The sum of the interior angles of a **quadrilateral** is 360° .



10. Using your own words, explain what the statement above means.

11. (a) Do you agree with the statement above? _____

(b) Give your reason. _____



Make notes describing how you completed the investigation. Keep these notes to refer to when completing the Self-evaluation task. Your teacher may wish you to forward these notes.

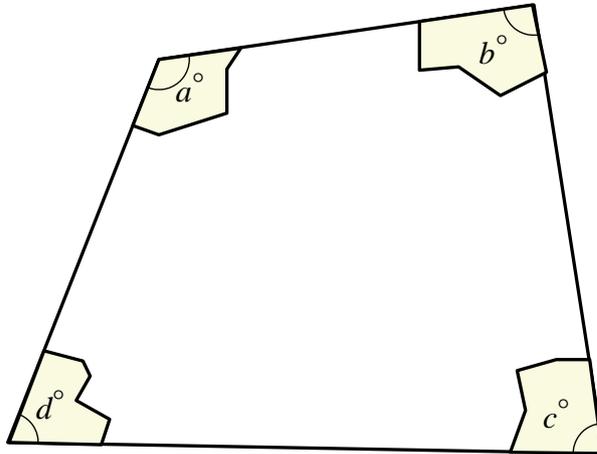


Check your work before continuing.

Activity 5.1 – Angles in a quadrilateral

One revolution is a complete turn or 360° . In this activity, we are going to use this to show that the interior angles of a **quadrilateral** add to 360° .

- Trace the following quadrilateral onto a piece of paper that you can cut. (You are eventually going to be required to cut the shape out.)



- Measure each of the interior angles in the quadrilateral.

$$a^\circ = \underline{\hspace{2cm}}^\circ$$

$$b^\circ = \underline{\hspace{2cm}}^\circ$$

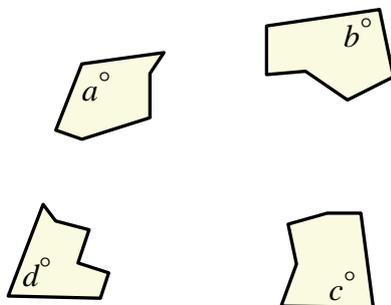
$$c^\circ = \underline{\hspace{2cm}}^\circ$$

$$d^\circ = \underline{\hspace{2cm}}^\circ$$

- Add them together and check that they total 360° .

$$a + b + c + d = \underline{\hspace{2cm}}$$

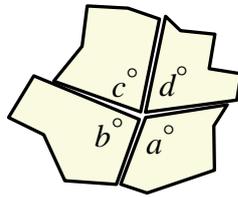
- Now cut out the quadrilateral and then tear off each corner. (We are only interested in keeping the corners as they contain the angles that we require.)



So that you can follow the next step correctly, you may like to mark the corners with a pen.



5. Place your four corners together as shown in the following diagram. (It does not matter in what order, as long as you fit the corners containing the angles together.)

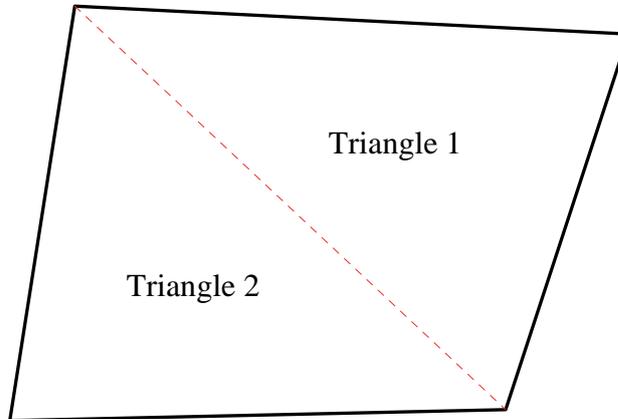


6. Do your angles fit together to complete a revolution (360°)? _____
7. What can you deduce about the interior angles of a **quadrilateral** from question 5? Give your reasoning.
- _____
- _____
8. Will this happen with a different quadrilateral? _____
9. Draw another quadrilateral of your own, tear off the angles and glue them below, in a similar way to question 5.

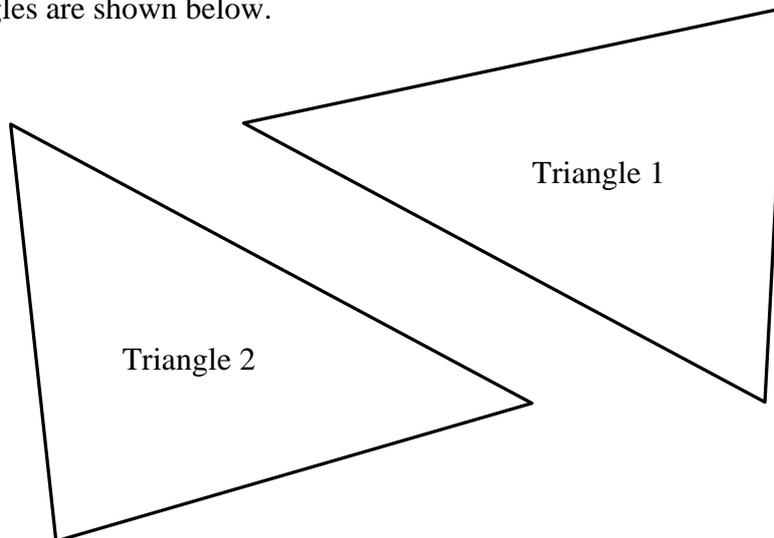
Activity 5.2 – Angles in a quadrilateral

The interior angles in a triangle add to 180° . In this activity, we are going to use this to show that the interior angles of a **quadrilateral** add to 360° .

The quadrilateral below has been cut into two triangles.



The triangles are shown below.



- Predict the total of the sum of the interior angles for both triangles.

Triangle 1: _____

Triangle 2: _____

- Measure the interior angles for both triangles to see if your prediction in part 1 is correct.
- Add together the totals for each triangle.

Sum of the interior angles in Triangle 1: _____

+ Sum of the interior angles in Triangle 2: _____

Total: _____

4. Do you think that this will occur with all **quadrilaterals**? _____
5. Draw another quadrilateral in the space below.

6. Draw a line through the quadrilateral that splits it into two triangles.
7. Describe any possible errors that could affect your results, even if you did not make them.



Check your work before continuing.

6. Classifying quadrilaterals

When you complete this section you should be able to:

- classify quadrilaterals based on their angle and side properties.

Warm-up 6

1. $0.08 \times 10 =$ _____

2. $722 - 15 =$ _____

3. The temperature is minus 3 degrees.

How much will it need to increase to get to 3 degrees?

4. $\frac{7}{3} - \frac{1}{3} =$ _____

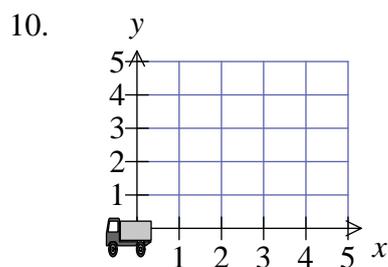
5. $\frac{5}{6} \times 12 =$ _____

6. $37 \text{ g} =$ _____ mg

7. $2 \times 5 - 5 =$ _____

8. Write 0.666... as a percentage. _____

9. $6\frac{5}{6}, 6\frac{4}{6}, 6\frac{3}{6},$ _____



At what point is the truck?

Review 6

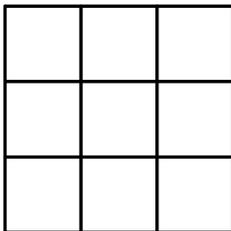
A quadrilateral is a four-sided polygon. It has four angles.

The following is an example of a quadrilateral.



The word quadrilateral is made up of the prefix 'quad' and the word 'lateral'. The prefix 'quad' means four and the word 'lateral' means 'sides'.

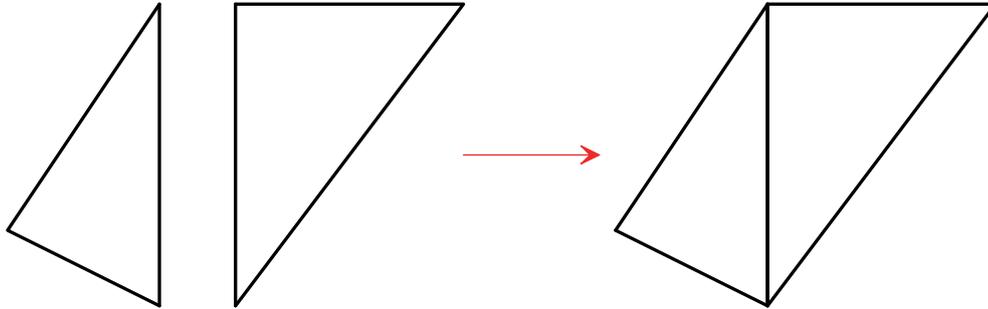
- How many sides does a quadrilateral have? _____
 - How many angles does a quadrilateral have? _____
- A square is a special type of quadrilateral. How many squares can you find in the diagram below?



Hint: It is not nine or ten.

Focus problem 6

Rachel found that if she combined two triangles together she could make up a quadrilateral, as long as one of the sides from each triangle was the same length.



Draw some different shaped triangles on a sheet of paper making sure that they all have one side the same length. Cut these triangles out and see how many different quadrilaterals you can make? (If you have access to a computer-drawing package, you may like to use that instead.)

What happens if you use two right-angled triangles or two equilateral triangles?

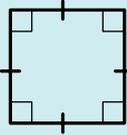
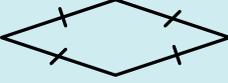
Draw a sketch of the shapes you make in the space below.



Check your work before continuing.

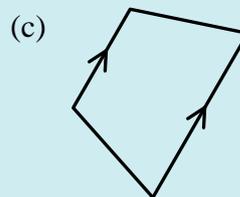
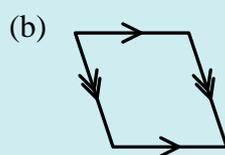
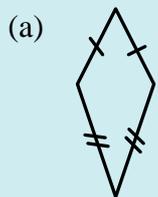
Skills development 6

Quadrilaterals can be classified according to their side and angle properties.

Name	Properties	Example
Trapezium	One pair of sides parallel	
Parallelogram	Opposite sides parallel	
Rectangle	All angles are 90°	
Square	All sides equal, all angles 90°	
Rhombus	All sides equal	
Kite	Two pairs of adjacent sides equal	

Example

Classify the following quadrilaterals.

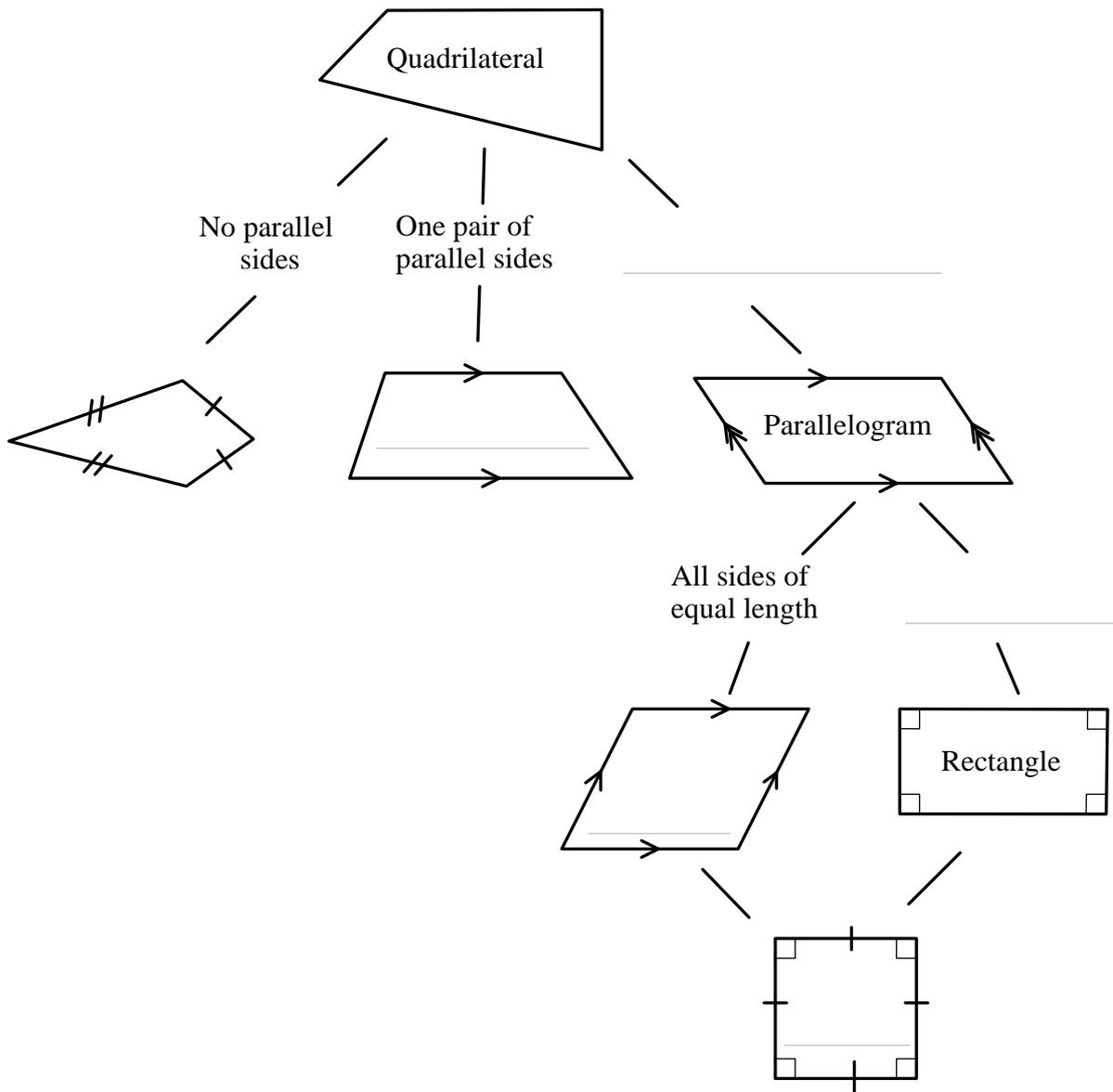


Solution

- (a) Kite
- (b) Parallelogram
- (c) Trapezium

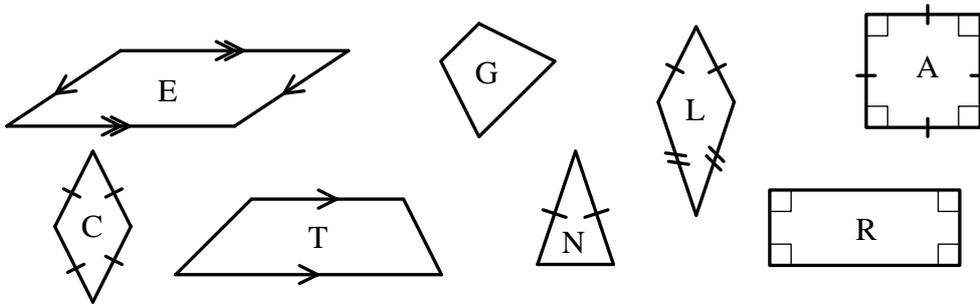
- List three other words that have the prefix 'quad'. Give a brief definition of each word listed.

- Complete the classification tree below.



3. Determine the shape that best matches each of the following names. Use these matches to solve the riddle below.

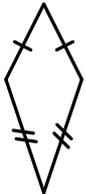
- I. Rhombus
- II. Quadrilateral
- III. Parallelogram
- IV. Kite
- V. Trapezium
- VI. Rectangle
- VII. Square
- VIII. Not a quadrilateral



What do you call a crushed angle?

VII	VI	III	I	V	VII	VIII	II	IV	III

4. How would you describe the following shape to a friend without using the words quadrilateral, kite or diamond? Write your description below.



5. (a) Can a square be classified as a rectangle? Give your reasoning.

(b) Can a rectangle be classified as a square? Give your reasoning.



Check your work before continuing.

7. Using quadrilateral properties

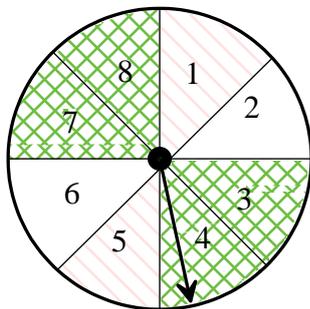
When you complete this section you should be able to:

- use quadrilateral properties to determine unknown sides and angles.

Warm-up 7

- $3 \div 10 =$ _____
- $324 \div 9 =$ _____
- The temperature is 5 degrees.
How much will it need to decrease to get to minus 5 degrees?
- $\frac{4}{5} + \frac{3}{10} =$ _____
- $\frac{3}{5} \times 45 =$ _____
- $0.005 \text{ L} =$ _____ mL
- $(7 + 3) \times 9 =$ _____
- Find 25% of \$84. _____
- Describe the rule for the following pattern. 1, 1, 2, 3, 5, 8, ...

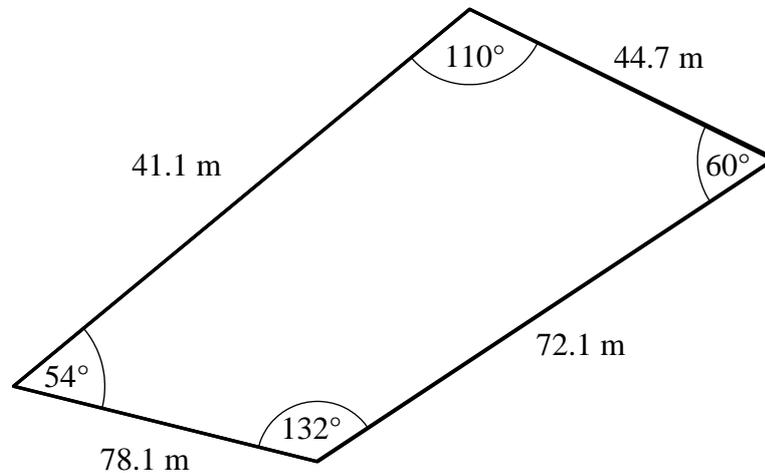
- Determine the probability that the spinner will land on a 4.



Express your answer as a percentage.

Focus problem 7

A land surveyor was dividing some blocks when he realised that he had an error in his measurements.



How did the surveyor know he had an error? That is, what about the measurements in the shape above tells the surveyor that he has an error?



Check your work before continuing.

Origami

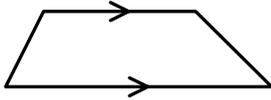
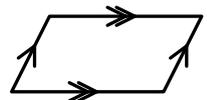
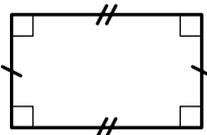
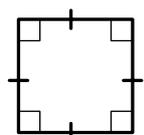
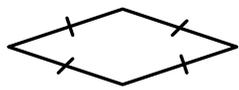
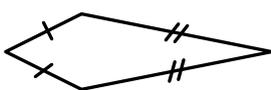
Origami is the art of paper folding. The Japanese are known to have a special relationship with this art form, however, there is some evidence that it may have originated elsewhere.

If you have some spare time and access to a computer, you may like to look it up or even make some models.



Activity 7

1. Use the following table, a sheet of paper and a protractor and/or a computer-drawing package to discover some of the other properties of these quadrilaterals. For example, see if you can find a relationship between the angles inside a trapezium.

Name	Properties	Example
Trapezium	One pair of sides parallel	
Parallelogram	Opposite sides parallel	
Rectangle	All angles are 90°	
Square	All sides equal, all angles 90°	
Rhombus	All sides equal	
Kite	Two pairs of adjacent sides equal	



Record your findings in your notebook.

2. Complete the table.

Name	Side properties	Angle properties
Square	Opposite sides parallel and all sides are equal in length	
	One pair of sides is parallel	Adjacent angles (that are co-interior to the parallel lines) add to 180°
	Two pairs adjacent sides are equal in length	Angles between unequal sides are equal in size
Rhombus		Opposite angles are equal in size and adjacent angles add to 180°
	Opposite sides are parallel and equal in length	Opposite angles are equal in size and adjacent angles add to 180°
Rectangle		All angles are 90°



Check your work before continuing.

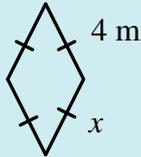
Skills development 7

Missing angles and sides can be determined by using your knowledge about quadrilaterals and their properties.

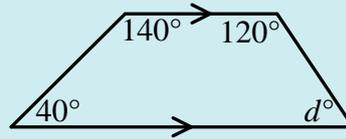
Example

Determine the unknown for each of the following.

(a)



(b)



Solution

(a) The shape is a rhombus as the sides are marked all the same. Therefore, the unknown side is 4 m.

(b) The sum of the interior angles in a quadrilateral is 360° .

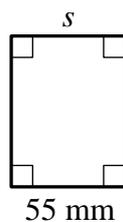
$$\begin{aligned} d &= 360 - 140 - 120 - 40 \\ &= 60 \end{aligned}$$

Therefore, the unknown angle is 60° .

1. The sum of the four angles in a quadrilateral is _____ degrees.

2. Determine the unknown for each of the following and give your reasoning.

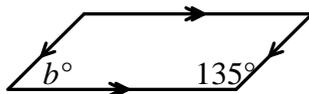
(a)



$$s = \underline{\hspace{2cm}}$$

Reason: _____

(b)

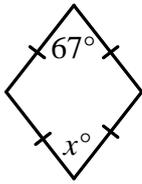


$$b = \underline{\hspace{2cm}}$$

Reason: _____

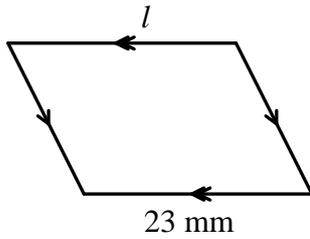
3. Determine the unknown for each of the following.

(a)



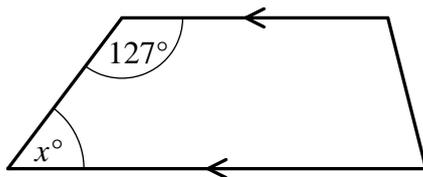
$x =$ _____

(b)



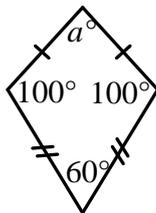
$l =$ _____

(c)



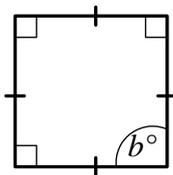
$x =$ _____

(d)



$a =$ _____

(e)



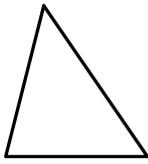
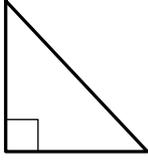
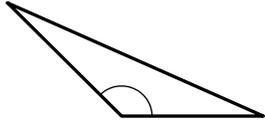
$b =$ _____



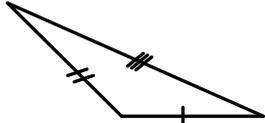
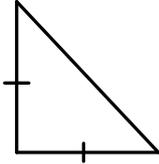
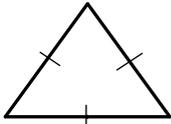
Check your work before continuing.

8. Summary

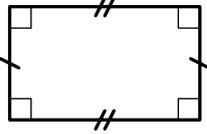
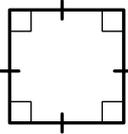
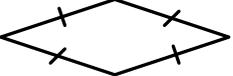
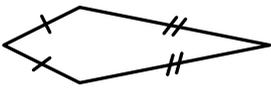
- The sum of the interior angles of a triangle is 180° .
- Triangles can be classified according to the sizes of their angles.

Size of angles	Name	Example
Three acute angles	Acute-angled triangle	
One angle 90°	Right-angled triangle	
One angle greater than 90°	Obtuse-angled triangle	

- Triangles can be classified according to their side lengths.

Side lengths	Name	Example
No sides equal	Scalene triangle	
Two sides equal	Isosceles triangle	
All sides equal	Equilateral triangle	

- The sum of the interior angles of a quadrilateral is 360° .
- Quadrilaterals can be classified according to their side and angle properties.

Name	Properties	Example
Trapezium	One pair of sides parallel	
Parallelogram	Opposite sides parallel	
Rectangle	All angles are 90°	
Square	All sides equal, all angles 90°	
Rhombus	All sides equal	
Kite	Two pairs of adjacent sides equal	

9. Review tasks

The following tasks will assist you to consolidate your learning and understanding of the concepts introduced in this resource, and assist you to prepare for assessments.

Task A

Name: _____

Suggested time: 45 minutes

Actual time taken: _____

Instructions

Complete this work on your own.

You may use a calculator, but show how you got your answer.

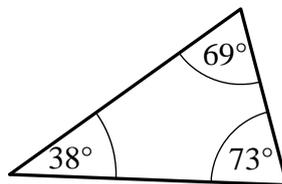
Attempt every question. Take as long as you need and record the time in the space provided above after you have finished.

1. Complete the following.

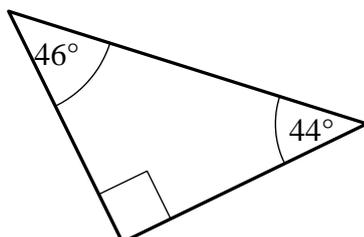
- (a) An _____-angled triangle has all three angles less than 90° .
- (b) An _____-angled triangle has one angle greater than 90° .
- (c) A _____-angled triangle has one angle of 90° .

2. Classify the following triangle using its angle properties.

(a)



(b)



3. Explain why a triangle cannot have two right angles.

4. Complete the following.

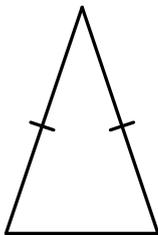
(a) An _____ triangle has all sides the same length.

(b) An _____ triangle has two sides of the same length.

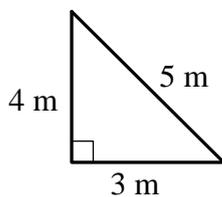
(c) A _____ triangle has no sides the same length.

5. Classify the following triangle using its side properties.

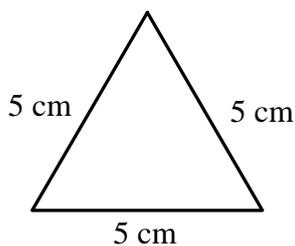
(a)



(b)

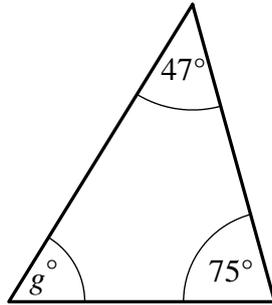


(c)



6. Explain why a right-angled triangle cannot be an equilateral triangle.

7. The sum of the three angles in a triangle is _____ degrees.
8. Determine the unknown for the following and give your reasoning.

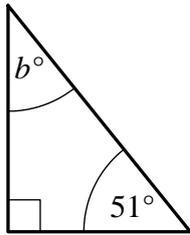


$$g = \underline{\hspace{2cm}}$$

Reason: _____

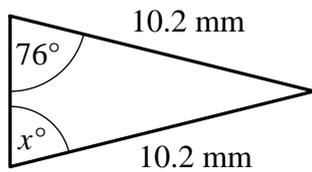
9. Determine the unknown for each of the following.

(a)



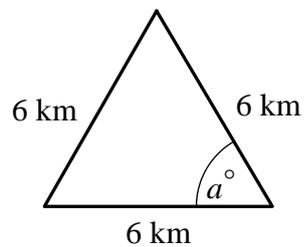
$$b = \underline{\hspace{2cm}}$$

(b)



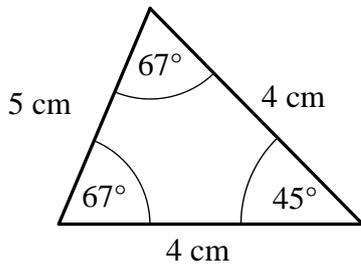
$$x = \underline{\hspace{2cm}}$$

(c)



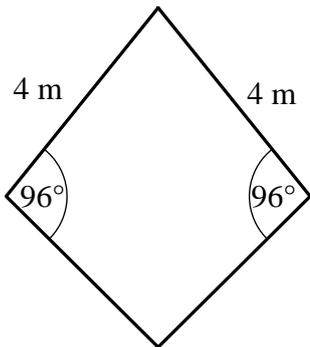
$$a = \underline{\hspace{2cm}}$$

10. Explain why a triangle having these measurements cannot be drawn.

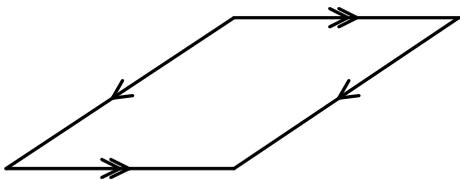


11. Classify the following quadrilaterals.

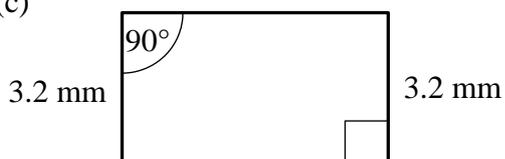
(a)



(b)



(c)

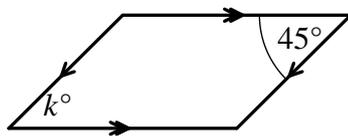


12. (a) Can a trapezium be classified as a parallelogram? Give your reasoning.

(b) Can a parallelogram be classified as a trapezium? Give your reasoning.

13. The sum of the four angles in a quadrilateral is _____ degrees.

14. Determine the unknown for the following and give your reasoning.

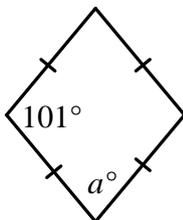


$k =$ _____

Reason: _____

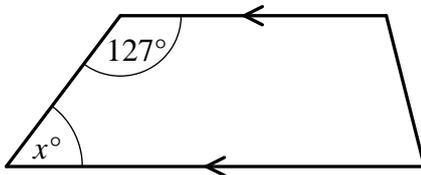
15. Determine the unknown for each of the following.

(a)



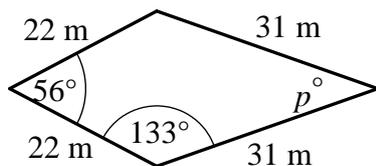
$a =$ _____

(b)



$x =$ _____

(c)



$p =$ _____

Task B

Name: _____

Suggested time: 45 minutes

Actual time taken: _____

Instructions

Complete this work on your own.

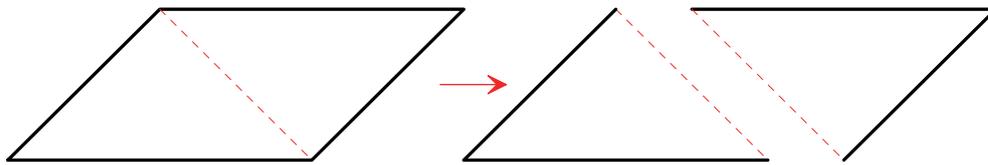
You may use a calculator, but show how you got your answer.

Attempt every question. Take as long as you need and record the time in the space provided above after you have finished.

Investigate the sum of the interior angles of polygons by completing the following.

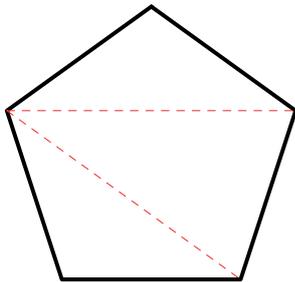
- The sum of the interior angles in a triangle is _____ degrees.

A quadrilateral can be split into two triangles. The parallelogram below is an example.



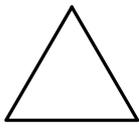
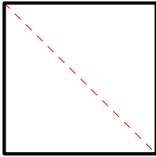
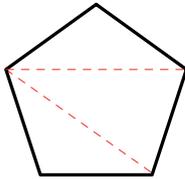
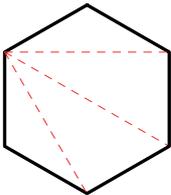
- The sum of the interior angles in a quadrilateral is _____ degrees.

A pentagon is shown below. It has been cut into triangles using two diagonals taken from the same vertex.



- Record your prediction for the sum of the interior angles. _____
- How could you test to see if your prediction is correct?

5. Complete the following table.

Number of sides	Name	Diagram	Number of diagonals*	Number of triangles	Sum of interior angles (degrees)
3			0	1	180
	Quadrilateral		1	2	
5	Pentagon		2		540
6				4	720

*Note that for each shape, the diagonals are drawn from the same vertex.

6. Describe any patterns that you can see from the table above.

7. How can you find the number of triangles created, given the number of sides of a polygon?

8. How can you find the sum of the interior angles, given the number of sides of a polygon?

9. Determine the sum of the interior angles of a decagon (ten-sided shape). _____

10. Describe the rule for determining the sum of the interior angles of any polygon.

The sides of a regular polygon are all the same length, which also means the angles are all the same size. The sum of the interior angles of a pentagon is 540° . It has five sides and five angles.

11. If the pentagon is regular, how could you find the size of each interior angle?

12. Determine the size of one of the interior angles of a regular pentagon. _____

13. How could you find the size of the interior angles given any regular polygon?

Self-evaluation task

Please complete the following.

How well did you manage your own learning using this resource?

	Always	Usually	Rarely	Not sure
Each section took approximately 45 minutes to complete.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I needed extra help.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I marked and corrected my work at the end of each section.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I made the journal entries and summaries when asked.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I have kept to my work schedule.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How much mathematics have you learnt using this resource?

	Always	Usually	Rarely	Not sure
<i>Understanding</i> I can identify differences and similarities between the different types of triangles and quadrilaterals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Fluency</i> I can classify triangles and quadrilaterals according to their side and angle properties.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Problem Solving</i> I can calculate missing angles and sides of triangles and quadrilaterals using my knowledge of their properties.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Reasoning</i> I can apply known facts to draw conclusions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Write a list of topics for which you need additional assistance. Discuss these with your teacher.

Solutions

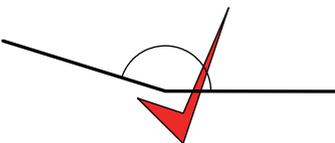
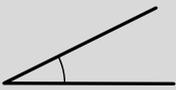
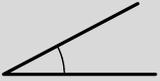
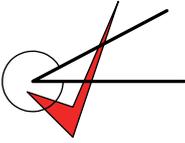
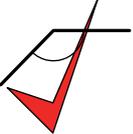
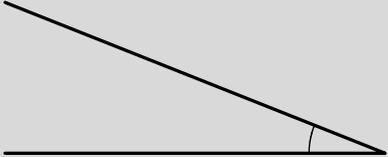
1. Reviewing angles

Solutions to Warm-up 1

1. The factors of 8 are 1, 2, 4 and 8.
2. 16
3. (-40)
4. $\frac{3}{4}$ is the greater fraction.
5. 6
6. 12.8
7. 32.4
8. $\frac{1}{6}$
9. 35
10. 90°

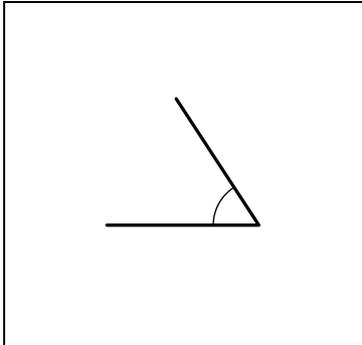
Solutions to Review 1.1

1. Solutions are as shown, with the larger angle ticked for each pair.

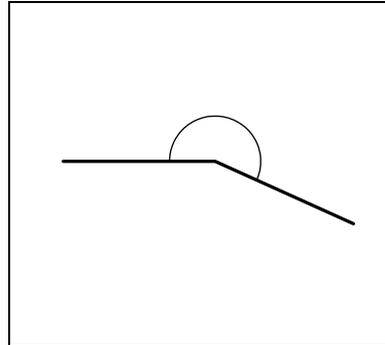
(a) 	
	(b) 
(c) 	

2. Solutions may vary. Please check your answers with your teacher.
An example of each angle is shown below.

(a) smaller than angle A



(b) larger than angle A



Solutions to Review 1.2

1. Please check your estimates with another student or with your teacher.
- (a) 70°
 - (b) 120°
 - (c) 145°
 - (d) 85°
 - (e) 90°

Solutions to Review 1.3

1.
 - (a) straight
 - (b) obtuse
 - (c) right
 - (d) reflex
 - (e) revolution
 - (f) acute
2.
 - (a) Acute
 - (b) Straight
 - (c) Right
 - (d) Obtuse
 - (e) Revolution
 - (f) Reflex
 - (g) Right

2. Investigating triangles

Solutions to Warm-up 2

- 6
- 7
- (-2) degrees
- $\frac{5}{6} < \frac{3}{3}$
- 15
- 4
- 0.071
- 0.53
- 10.9
- (2, -3)

Solutions to Review 2

- Octagon
- A–II
B–IV
C–I
D–III
- 5 triangles (if you take into account the larger outer triangle)

Investigation 2 – Angles in a triangle

- Size of angle A: 50°
Size of angle B: 70°
Size of angle C: 60°
- $50^\circ + 70^\circ + 60^\circ = 180^\circ$
- Size of angle X: 34°
Size of angle Y: 40°
Size of angle Z: 106°
- $34^\circ + 40^\circ + 106^\circ = 180^\circ$
- 5-6. Solutions will vary.
- The total of the angles should be 180° .
- Individual angle size may vary but you should find that your results are all the same. That is, they should all be 180° .

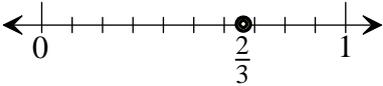
9. Solutions may vary. Possible errors could be created by inaccurate measuring, inaccuracy of measurement devices, rounding and computational errors.
10. Solutions will vary. You should provide your own meaning for the statement that the sum of the interior angles on any triangle is 180° . For example, the inside angles of a triangle add up to 180° .
11. Solutions will vary. If you do not agree with the statement, check your reasoning with another student and with your teacher.

Activity 2 – Angles in a triangle

1. No solution required
2. $a^\circ = 60^\circ$
 $b^\circ = 40^\circ$
 $c^\circ = 80^\circ$
3. $60 + 40 + 80 = 180$
- 4-5. No solution required
6. The answer should be yes.
7. The sum of the interior angles is 180° as they form a straight angle.
8. This is the case for all triangles.
9. No solutions required.

3. Classifying triangles

Solutions to Warm-up 3

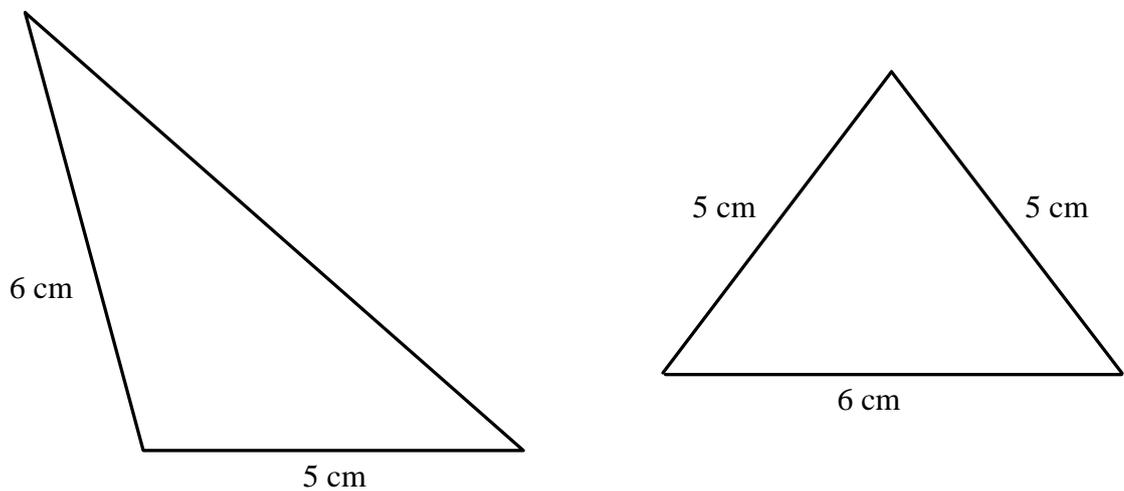
1. 7 and 11 are prime numbers.
2. 64
3. (-1)
4. 
5. 12
6. $25 + 9 = 34$
7. 26
8. 37.5%
9. $\frac{10}{4}$ or $2\frac{1}{2}$
10. Factors of 6 are 1, 2, 3 and 6. $P(\text{factors of } 6) = \frac{4}{6}$ or $\frac{2}{3}$

Solutions to Review 3

- Three
 - Three
 - Solutions may vary. The following are some words that have the prefix 'tri':
triceratops, tricycle, triathlon, tricentenary, triceps.
- No, a triangle cannot have an interior angle greater than 180° , as the sum of the interior angles is 180° .

Solution to Focus problem 3

What you were asked to do was to create a different triangle with the same measurements for two of the sides as in the first triangle. For example, the following triangles can be drawn.



This shows you that more information is needed to create the exact triangle.

Triangles can be classified by their angle and side properties. You could then use this type of classification to help create the exact triangle. For example, the person calling the hardware store might request an isosceles triangle with a base of 6 m and another side of 5 m. There is only one type of triangle that can be created using this description.

Solutions to Skills development 3.1

- acute
 - obtuse
 - right
- Obtuse-angled triangle
 - Acute-angled triangle
 - Right-angled triangle
 - Acute-angled triangle
- Solutions may vary. A possible explanation would be, two obtuse angles in a triangle would mean that the sum of the interior angles would be greater than 180° .

Solutions to Skills development 3.2

- equilateral
 - isosceles
 - scalene
- Scalene triangle
 - Isosceles triangle
 - Equilateral triangle
 - Isosceles triangle
- Solutions may vary. A possible explanation would be, in an equilateral triangle, the angles are all equal and together they must add to 180° .

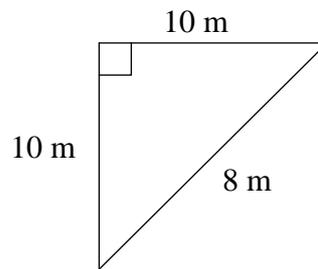
4. Using triangle properties

Solutions to Warm-up 4

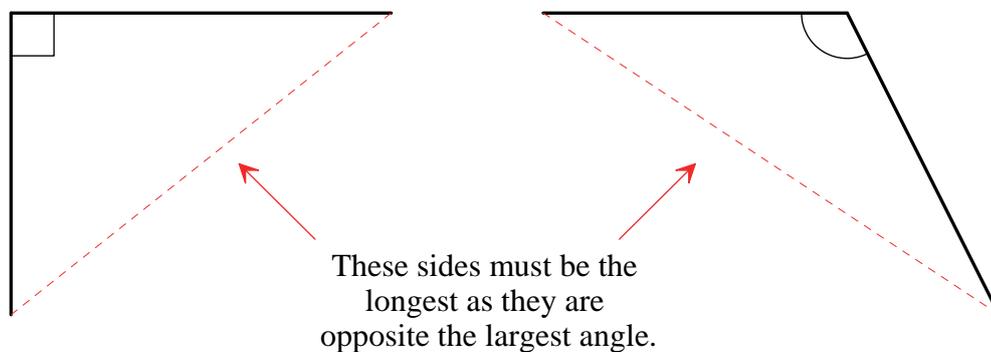
- 9, as it is the only composite number. The rest are primes.
- 9
- 4 degrees
- $\frac{6}{8}$ or $\frac{3}{4}$
- 16
- 0.5001
- 4.16
- $\frac{125}{100}$ or $1\frac{1}{4}$
- 66
- Triangle

Solution to Focus problem 4

What you were asked to do was to determine the error regarding the measurements of the following triangle.



Solutions may vary so please check your answer with another student or teacher. A possible solution is the side measuring 8 metres is opposite the largest angle of 90° . However, the other sides are larger. This is impossible!



Solutions to Skills development 4

1. 180°

2. (a) $g = 90$

Reason: The sum of the three angles is 180° .

$$\text{So, } g = 180 - 50 - 40$$

$$= 90.$$

(b) $h = 32 \text{ mm}$

Reason: The triangle is an isosceles triangle, as indicated by the identical marks.

3. (a) $b = 53$ (Right triangle, $b = 180 - 37 - 90$)

(b) $x = 60$ (Equilateral triangle, $x + x + x = 180$)

(c) $a = 60$ (Equilateral triangle)

(d) $p = 2.1 \text{ mm}$ (Isosceles triangle)

(e) $m = 49$ (Isosceles triangle)

4. Solutions may vary. For example, the angles do not add to 180° , or the smallest side is opposite the largest angle, which is impossible.
- 5.

Name	Side properties	Angle properties
Scalene	All sides are different lengths	All angles are different sizes
Equilateral	All sides the same length	All angles equal in size
Right-angled	Sides can either be different lengths or two sides can be the same length	One angle must be 90°
Acute-angled	Sides can either be different lengths or two sides the same length or all the same length	All angles are less than 90°
Isosceles	Two sides must have the same length	Two angles must be the same size
Obtuse-angled	Sides can either be different lengths or two sides can be the same length	One angle must be greater than 90°

5. Investigating quadrilaterals

Solutions to Warm-up 5

- 3
- 533
- 2
- $\frac{3}{3}$ or 1
- 20
- 0.02 cm
- 22
- 2.25
- 0.09
- 55°

Solutions to Investigation 5

1. Size of angle A: 100°
Size of angle B: 60°
Size of angle C: 120°
Size of angle D: 80°
2. 360°
3. Size of angle W: 78°
Size of angle X: 100°
Size of angle Y: 85°
Size of angle Z: 97°
4. 360°
5. Solutions will vary. Ensure that a ruler or drawing template has been used.
6. No solutions required.
7. 360°
8. They are all the same.
9. Solutions may vary. Possible errors could be created by inaccurate measuring, inaccuracy of measurement devices, rounding and computational errors.
10. Solutions will vary. You should provide your own meaning for the statement that the sum of the interior angles on any quadrilateral is 360° .
11. Solutions will vary. If you do not agree with the statement, check your reasoning with another student and with your teacher.

Solutions to Activity 5.1

1. No solution required.
2. $a^\circ = 120^\circ$
 $b^\circ = 90^\circ$
 $c^\circ = 80^\circ$
 $d^\circ = 70^\circ$
3. $120 + 90 + 80 + 70 = 360$
- 4–5. No solutions required.
6. The answer should be yes. You should find the angles do form a revolution (360°).
7. As the interior angles of a quadrilateral form a revolution then they should add to 360° .
8. Individual angle sizes may vary, however you should find it is always true. That is, the angle sizes add to 360° .
9. No solution required.

Solutions to Activity 5.2

1. No solution required as this is a prediction. Both triangles should have the sums of their interior angles adding up to 180° .
2. Angle sizes should add to 180° for both triangles.
3. $180 + 180 = 360$
4. Solutions may vary, however, it is always true.
5. No solution required.
6. No solution required.
7. Solutions may vary. Possible errors could be created by inaccurate measuring, inaccuracy of measurement devices, rounding and computational errors.

6. Classifying quadrilaterals

Solutions to Warm-up 6

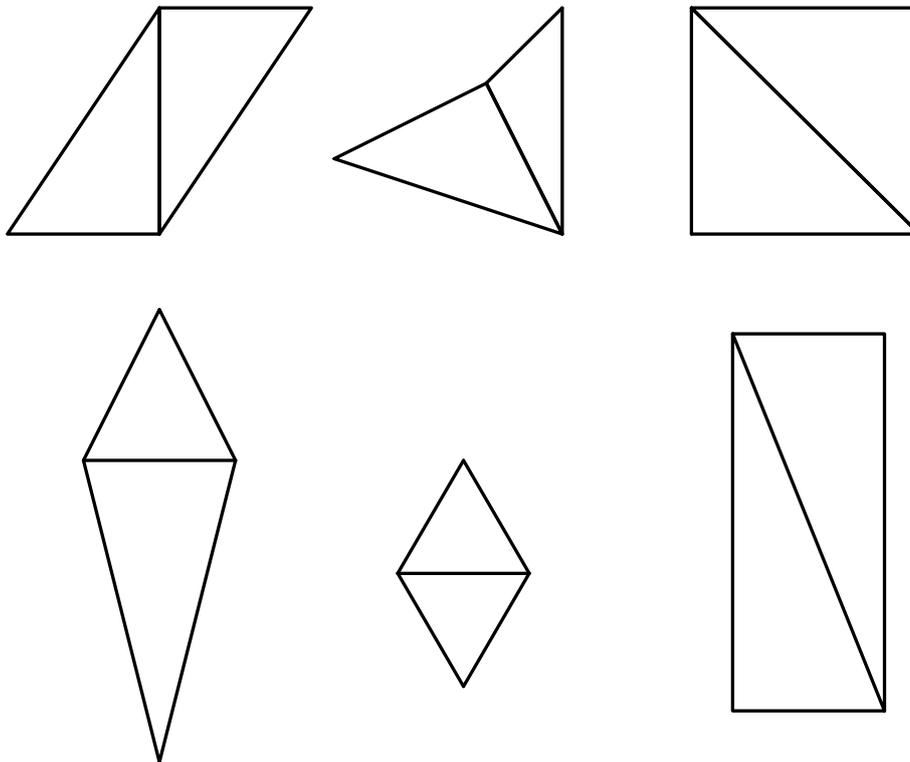
1. 0.8
2. 707
3. 6 degrees
4. $\frac{6}{3}$ or 2
5. 10
6. 37 000 mg
7. 5
8. $66.666\dots\%$ (or $66\frac{2}{3}\%$)
9. $6\frac{2}{6}$ or $6\frac{1}{3}$
10. (0, 0) or the origin

Solutions to Review 6

1. (a) four
(b) four
2. $9 + 4 + 1 = 14$ squares
Nine 1 by 1 squares, four 2 by 2 squares, one 3 by 3 square

Solution to Focus problem 6

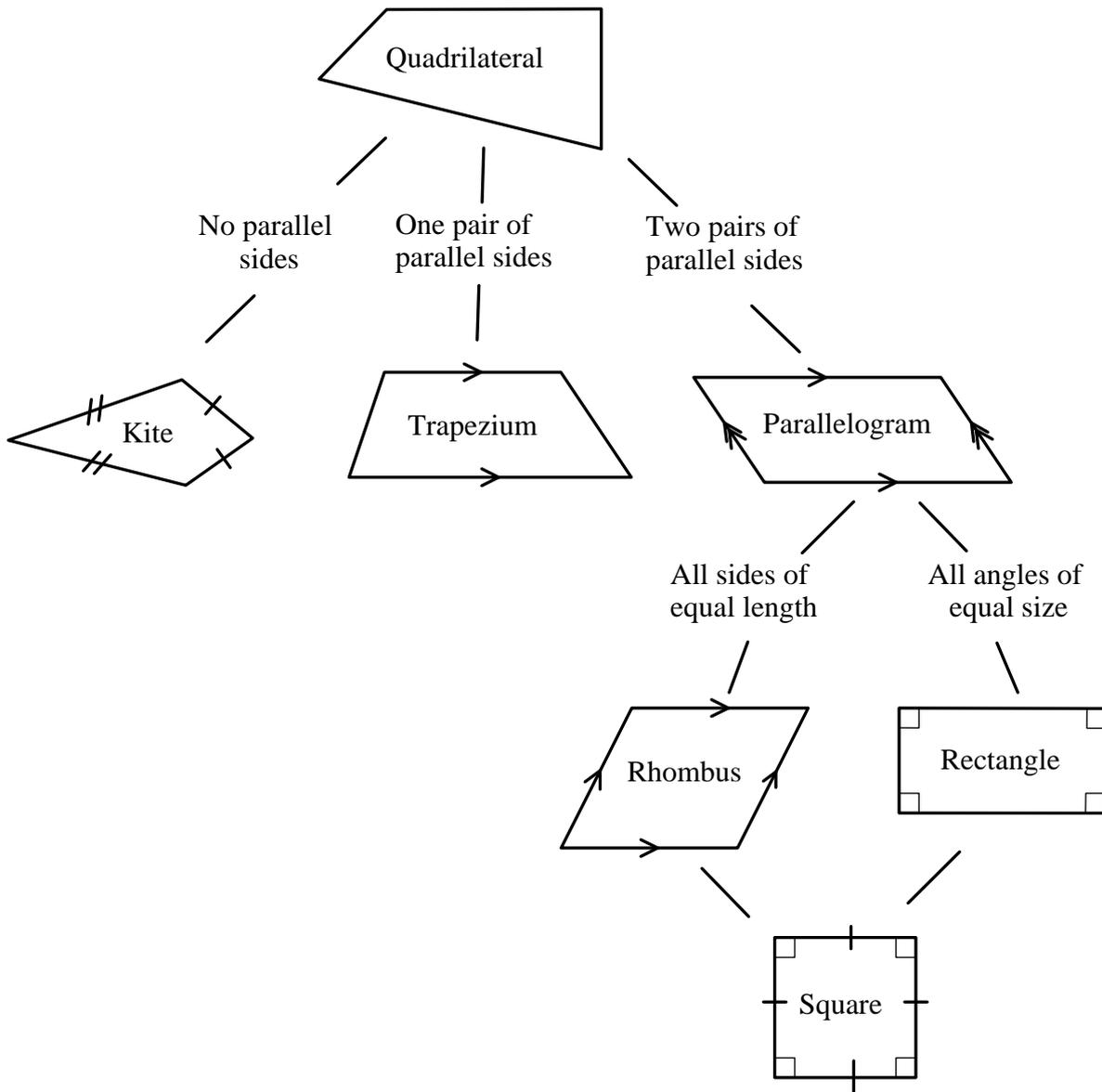
What you were asked to do was to create different quadrilaterals from a set of two triangles. Some examples of the type of shapes are shown below.



Solutions to Skills development 6

1. Solutions may vary. The following are some words that have the prefix ‘quad’:
 quadrangle, quadraphonic, quadriceps, quadruplet, quadruple.

2.



3. What do you call a crushed angle?

A	R	E	C	T	A	N	G	L	E
VII	VI	III	I	V	VII	VIII	II	IV	III

4. Solutions may vary. A possible description would be, it is a four-sided polygon, with no sides parallel and with adjacent sides equal in length.
5. Yes, a square is a special type of rectangle. It has all the properties of a rectangle, with the additional property of its sides being equal in length.
6. No, a rectangle does not necessarily represent a square as its side lengths might not all be equal in length. (Note that the opposite sides are equal in length.)

7. Using quadrilateral properties

Solutions to Warm-up 7

- 0.3
- 36
- 10 degrees
- $\frac{11}{10}$ or $1\frac{1}{10}$
- 27
- 5 mL
- 90
- \$21
- The next number is the sum of the previous two numbers.
- 12.5%

Solution to Focus problem 7

What you were asked to do was to determine how the surveyor knew that he had an error.

The most obvious answer (once you add the angles up) is that the sum of the interior angles do not add to 360° . Another indicator is that the combination of the two smallest sides is opposite the largest angle whereas the combination of the two largest angles is opposite the smaller of the obtuse angles.

Solutions to Activity 7

1. No solutions required.

2.

Name	Side properties	Angle properties
Square	Opposite sides parallel and all sides are equal in length	All angles are 90°
Trapezium	One pair of sides is parallel	Adjacent angles (that are co-interior to the parallel lines) add to 180°
Kite	Two pairs of adjacent sides are equal in length	Angles between unequal sides are equal in size
Rhombus	All sides are the same length	Opposite angles are equal in size and adjacent angles add to 180°
Parallelogram	Opposite sides are parallel and equal in length	Opposite angles are equal in size and adjacent angles add to 180°
Rectangle	Opposite sides are parallel and equal in length	All angles are 90°

Solutions to Skills development 7

1. 360

2. (a) $s = 55$ mm

Reason: The shape is a rectangle and opposite sides are equal.

(b) $b = 45$

Reason: The shape is a parallelogram and adjacent angles add to 180° .

$$\begin{aligned} \text{So, } b &= 180 - 135 \\ &= 45. \end{aligned}$$

3. (a) $x = 67$

(b) $l = 23$ mm

(c) $x = 53$

(d) $a = 100$

(e) $b = 90$

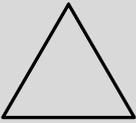
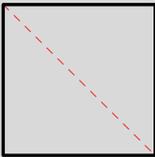
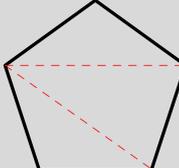
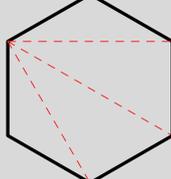
Solutions to Review tasks

Solutions to Task A

- Acute
 - Obtuse
 - Right
- Acute-angled triangle
 - Right-angled triangle
- Solutions may vary. Two right angles add to 180° , thus the third angle could not exist.
- Equilateral
 - Isosceles
 - Scalene
- Isosceles
 - Scalene
 - Equilateral
- Solutions may vary. A right-angled triangle has an angle of 90° , but the angles in an equilateral triangle are equal in size and must be 60° .
- 180
- $g = 58$ Reason: Angles in a triangle add to 180° . So, $g = 180 - 47 - 75 = 58$.
- 39
 - 76
 - 60
- Solutions may vary. The largest side is opposite the smallest angle. The sum of the angles does not add to 180° .
- Kite
 - Parallelogram
 - Rectangle
- No, because a parallelogram has two pairs of parallel sides.
 - Yes, because a trapezium only needs one pair of sides parallel.
- 360
- $k = 45^\circ$ Reason: Opposite angles in a parallelogram are equal.
- $a = 79$
 - $x = 53$
 - $p = 38$

Solutions to Task B

1. 180
2. 360
3. As it is a prediction, there is no wrong or right answer.
4. Solutions may vary. Use a protractor or computer-drawing package to measure the angles and then add them up.
- 5.

Number of sides	Name	Diagram	Number of diagonals*	Number of triangles	Sum of interior angles (degrees)
3	Triangle		0	1	180
4	Quadrilateral		1	2	360
5	Pentagon		2	3	540
6	Hexagon		3	4	720

6. Solutions will vary. Columns 1, 4, 5 are increasing by one and column 6 is increasing by 180.
7. Subtract two from the number of sides.
8. Subtract two from the number of sides and multiply the result by 180.
9. $(10 - 2) \times 180^\circ = 1440^\circ$
10. Subtract two from the number of sides and then multiply the result by 180.
11. Divide 540 by 5.
12. 108°
13. Subtract two from the number of sides and then multiply the result by 180, and then divide the answer by the number of sides.



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