Focus Workshop 2

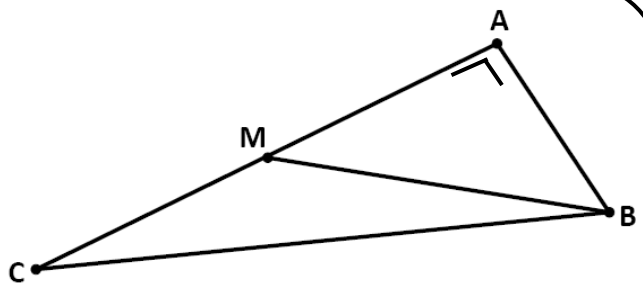
Strand 2 Geometry and Trigonometry

Number the following from 1 – 5 in order of difficulty

A

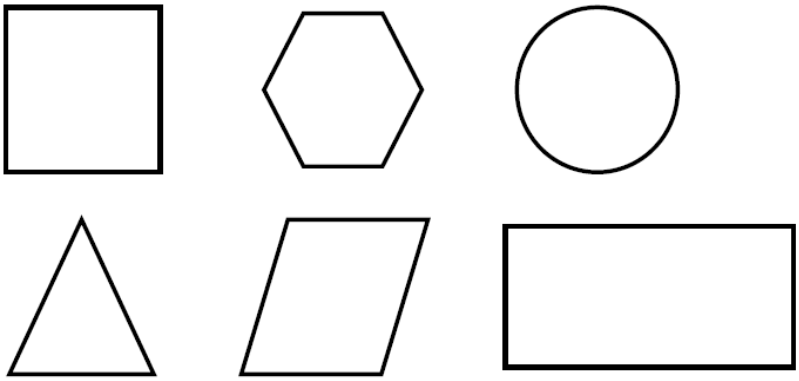
In ΔABC, BM is a median

Prove that
Area of Δ*ABM* = Area of Δ*MBC*



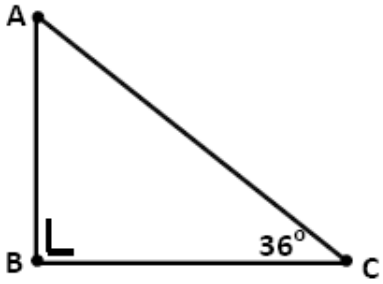
B

Name the following shapes



C

Find the angle ∠BAC



D

I have 4 sides and all of my interior angles are right angles.
What am I?

E

Prove that a vertex angle of a regular pentagon is trisected by diagonals drawn from that vertex.

Student Activity 1

Congruent Figures

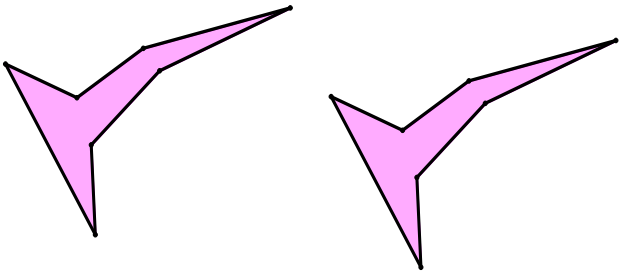
A. Consider the following and answer the questions

(i) Would the shape and size of a ruler change after you slide it along the desk?

_____

_____

(ii) When the paper aeroplane is moved from position 1 to position 2 would it change its shape and size?



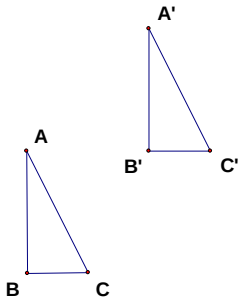
Position 1 Position 2

_____

_____

(iii) When △ ABC is moved to the position A'B'C' would its shape and size change?

_____

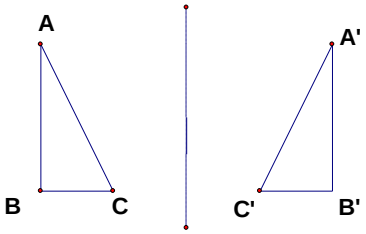


B (i) Does the reflection of a toothbrush have the same size and shape as the object?

_____

(ii) After △ ABC is reflected along the dotted line, would the image A'B'C' have the same shape and size as △ ABC?

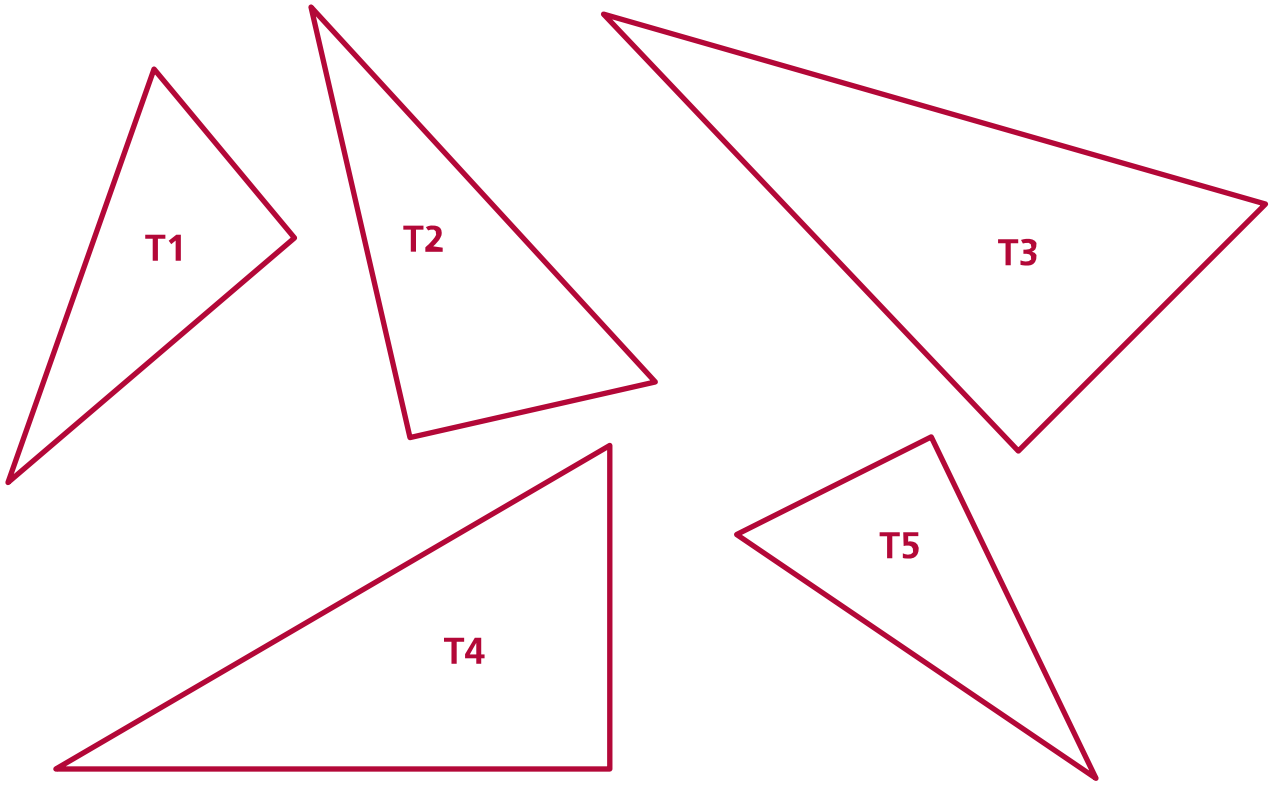
_____



Student Activity 3

Calculating ratios for similar right angled triangles with angles of 30°

- Measure the 90° and the 30° angles in the following triangles. What is the measure of the third angle?
- Label the hypotenuse as "hyp". With respect to the 30° angle, label the other sides as "adj" for adjacent and "opp" for opposite.
- Complete the table below.

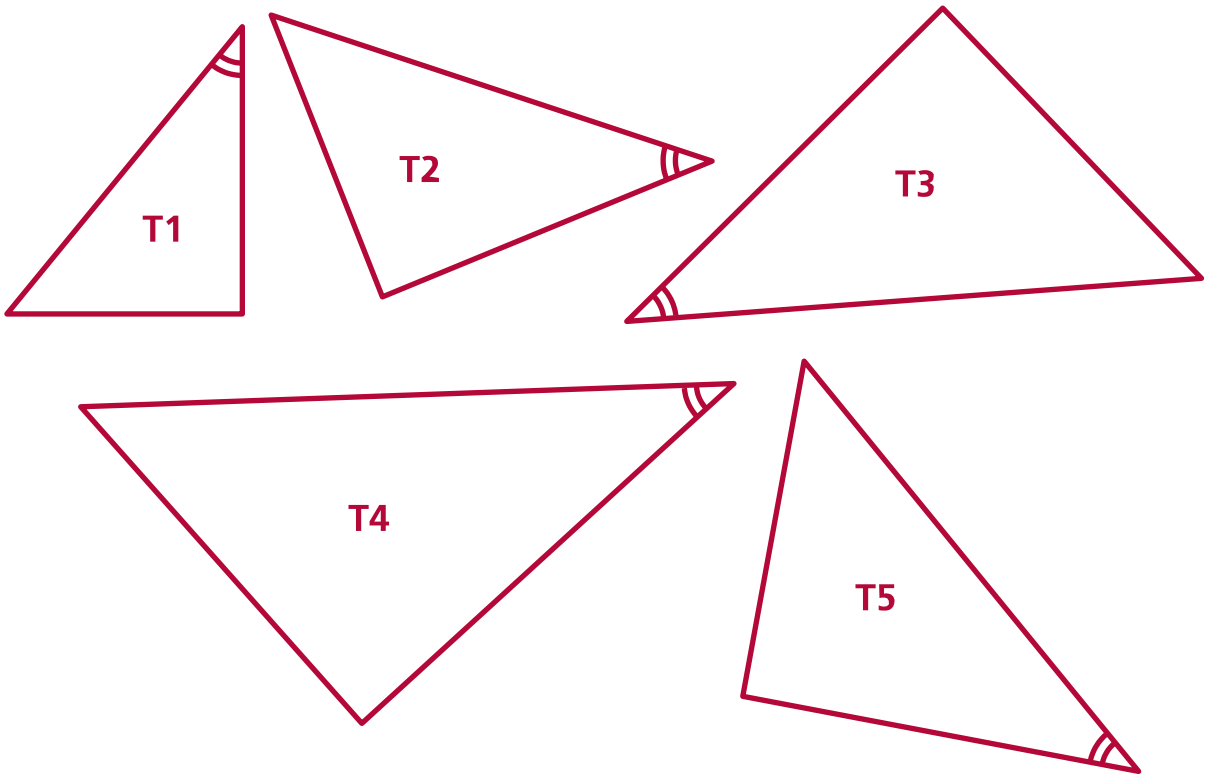


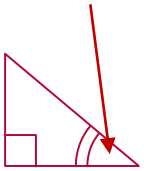
Marked Angle Size=30° 	|opp|/mm	|hyp|/mm	|adj|/mm	$\frac{opp}{hyp}$ (for angle=30°)		$\frac{adj}{hyp}$ (for angle=30°)		$\frac{opp}{adj}$ (for angle=30°)	
				fraction	**decimal**	**fraction**	**decimal**	**fraction**	**decimal**
T1									
T2									
T3									
T4									
T5									
Mean Value (correct to 2 decimal places)									

Student Activity 4

Calculating ratios for similar right angled triangles with angles of 40°

- Measure the 90° and the 40° angles in the following triangles. What is the measure of the third angle?
- Label the hypotenuse as "hyp". With respect to the 40° angle, label the other sides as "adj" for adjacent and "opp" for opposite.
- Complete the table below.

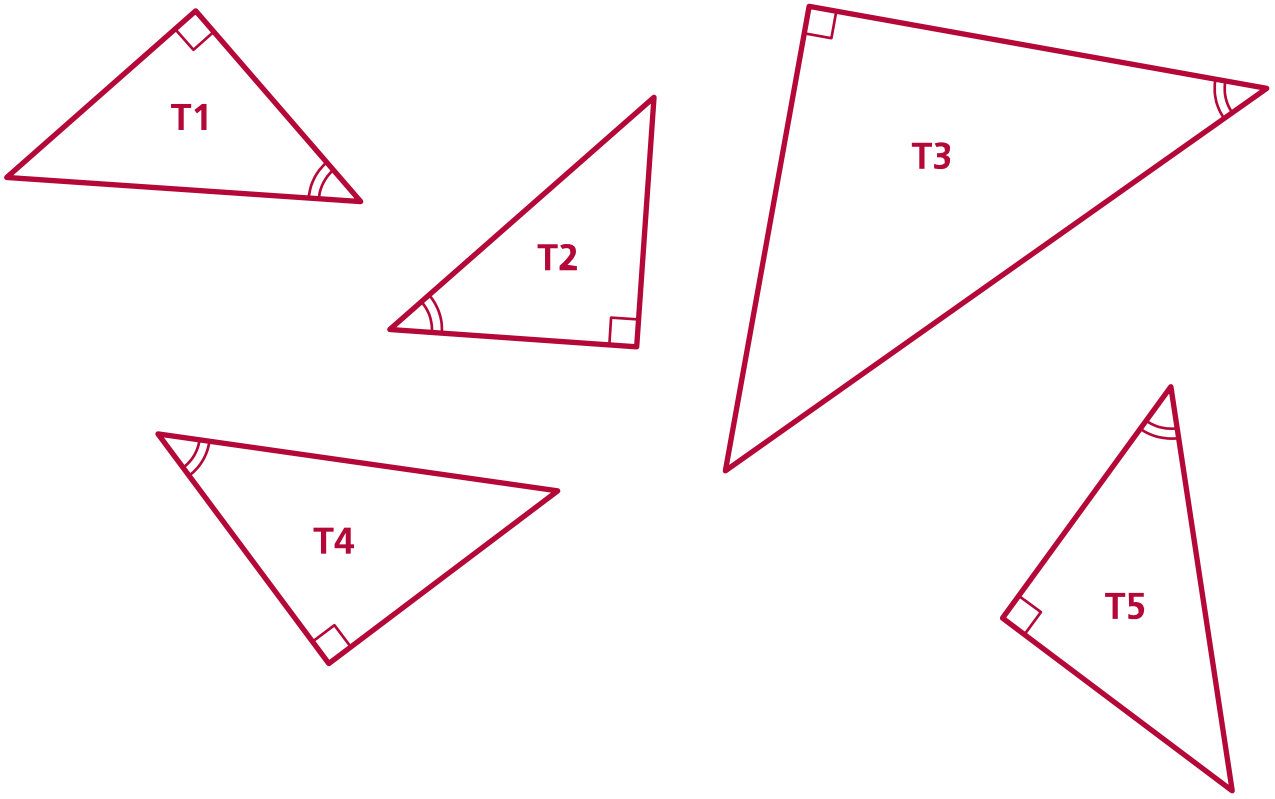


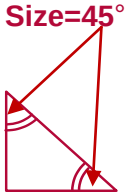
Marked Angle Size=40° 	|opp|/mm	|hyp|/mm	|adj|/mm	$\frac{\text{opp}}{\text{hyp}}$ (for angle=40°)		$\frac{\text{adj}}{\text{hyp}}$ (for angle=40°)		$\frac{\text{opp}}{\text{adj}}$ (for angle=40°)	
				fraction	**decimal**	**fraction**	**decimal**	**fraction**	**decimal**
T1									
T2									
T3									
T4									
T5									
Mean Value (correct to 2 decimal places)									

Student Activity 5

Calculating ratios for similar right angled triangles with angles of 45°

- Measure the 90° and the 45° angles in the following triangles. What types of right angled triangle are these triangles?
- Label the hypotenuse as "hyp". With respect to the 45° angle, label the other sides as "adj" for adjacent and "opp" for opposite.
- Complete the table below.

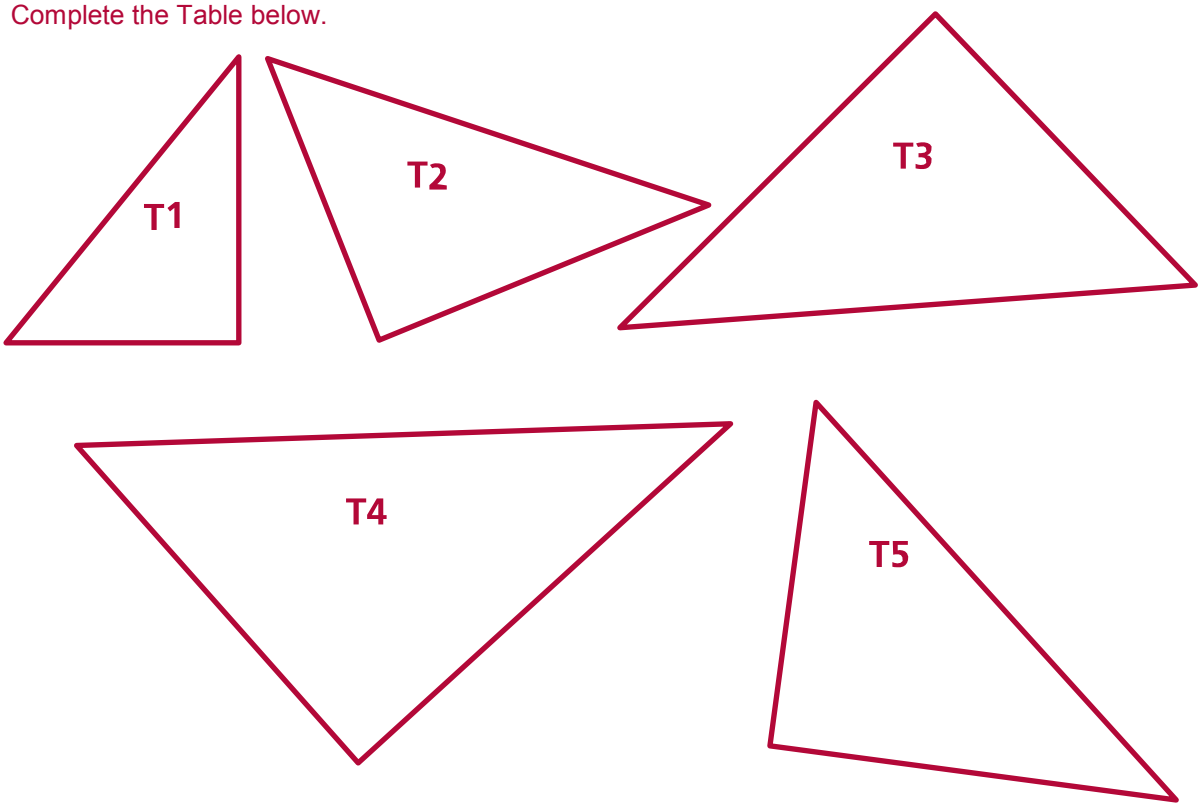


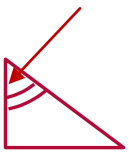
Marked Angle Size=45° 	|opp|/mm	|hyp|/mm	|adj|/mm	$\frac{\text{opp}}{\text{hyp}}$ (for angle=45°)		$\frac{\text{adj}}{\text{hyp}}$ (for angle=45°)		$\frac{\text{opp}}{\text{adj}}$ (for angle=45°)	
				fraction	**decimal**	**fraction**	**decimal**	**fraction**	**decimal**
T1									
T2									
T3									
T4									
T5									
Mean Value (correct to 2 decimal places)									

Student Activity 6

Calculating ratios for similar right angled triangles with angles of 50°

- Measure and label the 90° and the 50° angles in the following triangles. What is the measure of the third angle?
- Label the hypotenuse as "hyp". With respect to the 50° angle, label the other sides as "adj" for adjacent and "opp" for opposite.
- Complete the Table below.

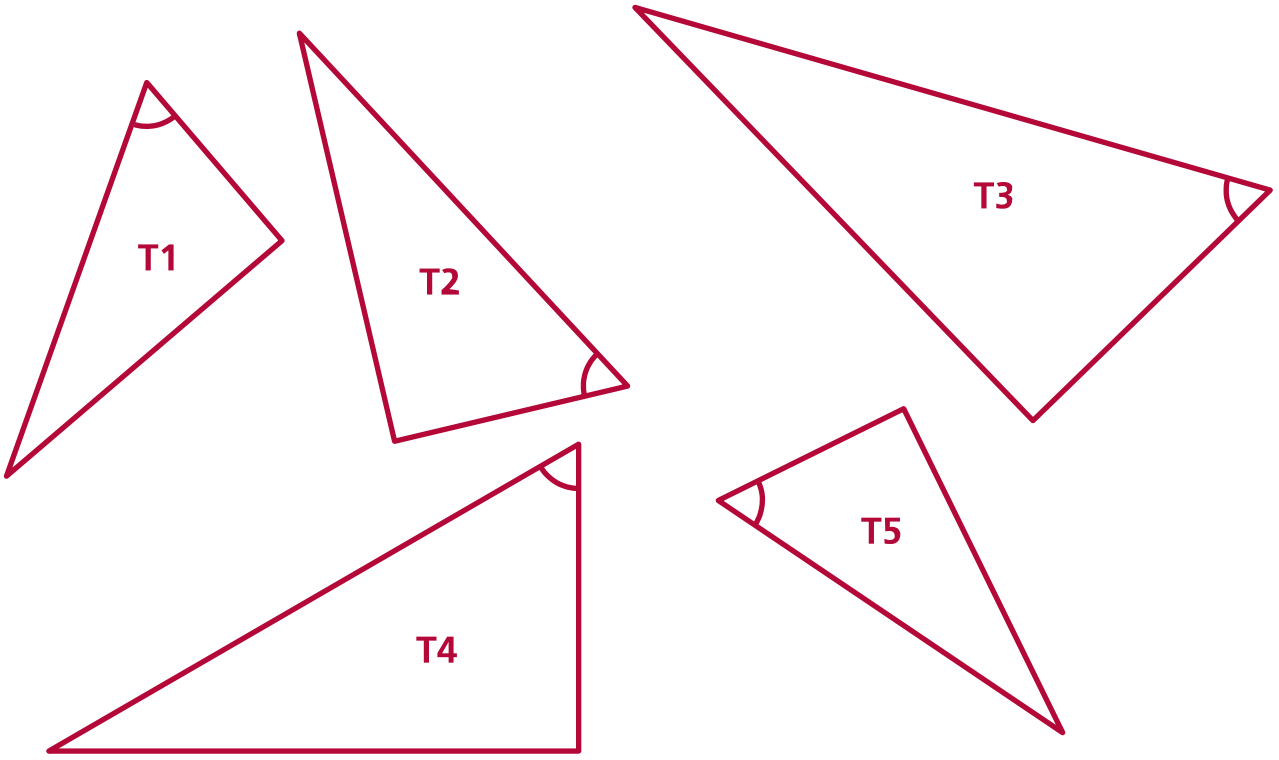


Marked Angle Size=50° 	|opp|/mm	|hyp|/mm	|adj|/mm	$\frac{opp}{hyp}$ (for angle=50°)		$\frac{adj}{hyp}$ (for angle=50°)		$\frac{opp}{adj}$ (for angle=50°)	
				fraction	**decimal**	**fraction**	**decimal**	**fraction**	**decimal**
T1									
T2									
T3									
T4									
T5									
Mean Value (correct to 2 decimal places)									

Student Activity 7

Calculating ratios for similar right angled triangles with angles of 60°

- Measure and label the 90° and the 60° angles in the following triangles. What is the measure of the third angle?
- Label the hypotenuse as “hyp”. With respect to the 60° angle, label the other sides as “adj” for adjacent and “opp” for opposite.
- Complete the table below.

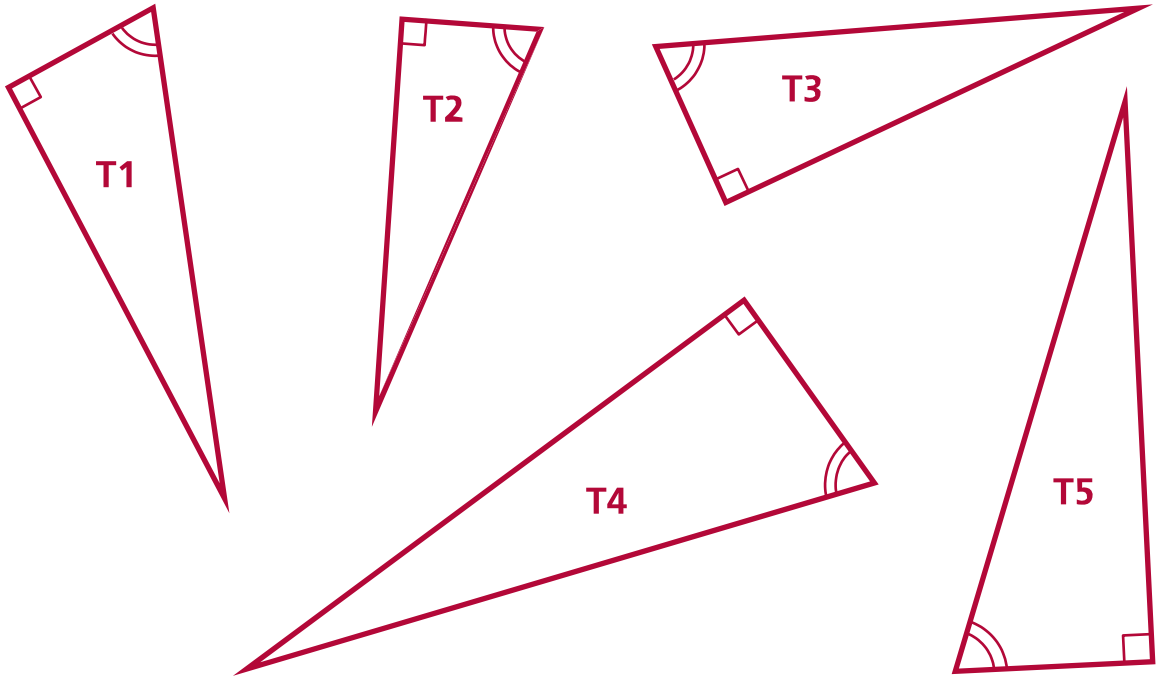


Marked Angle Size=60° 	|opp|/mm	|hyp|/mm	|adj|/mm	$\frac{\text{opp}}{\text{hyp}}$ (for angle=60°)		$\frac{\text{adj}}{\text{hyp}}$ (for angle=60°)		$\frac{\text{opp}}{\text{adj}}$ (for angle=60°)	
				fraction	**decimal**	**fraction**	**decimal**	**fraction**	**decimal**
T1									
T2									
T3									
T4									
T5									
Mean Value (correct to 2 decimal places)									

Student Activity 8

Calculating ratios for similar right angled triangles with angles of 70°

- Measure and label the 90° and the 70° angles in the following triangles. What is the measure of the third angle?
- Label the hypotenuse as "hyp". With respect to the 70° angle, label the other sides as "adj" for adjacent and "opp" for opposite.
- Complete the table below.



Marked Angle Size=70° 	|opp|/mm	|hyp|/mm	|adj|/mm	$\frac{\text{opp}}{\text{hyp}}$ **(for angle=70°)**		$\frac{\text{adj}}{\text{hyp}}$ **(for angle=70°)**		$\frac{\text{opp}}{\text{adj}}$ **(for angle=70°)**	
				fraction	**decimal**	**fraction**	**decimal**	**fraction**	**decimal**
T1									
T2									
T3									
T4									
T5									
Mean Value (correct to 2 decimal places)									

Student Activity 9

Project Maths Development Team

Master table of class results for ratios of sides in right angled triangles

Angle/°	$\frac{opp}{hyp}$	Check	$\frac{adj}{hyp}$	Check	$\frac{opp}{adj}$	Check
30°						
40°						
45°						
50°						
60°						
70°						

Student Activity 10

Project Maths Tionscadal Mata Development Team

Using the master table of class results answer the following questions

1. What do you notice about sin 30° and cos 60°? _____

_____

2. What do you notice about cos 30° and sin 60°? _____

_____

3. Can you explain what you have noticed using diagrams?

4. How would you describe angles 30° and 60°? _____

_____

5. Can you find similar examples in the master table? _____

_____

6. For what angle in a right angled triangle is the opposite side one half of the hypotenuse? _____

_____

Draw a diagram to illustrate your answer.

7. For what angle in a right angled triangle are the opposite and adjacent sides equal?

_____

8. Calculate $\frac{SinA}{CosA}$ for each angle A. Compare this to the value of Tan A. What do you notice? Can you justify the answer?_____

_____

_____

Theorem 8 Activity Sheet.

Part 1

1. Did the Geo Strips you choose form a triangle? _____
2. Measure the lengths in cm of the Geo Strips you have. (Measure from the centre of the end hole on one side of the Geo Strip to the centre of the end hole on the other side.)

   Length 1 _____

   Length 2 _____

   Length 3 _____
3. Add Length 1 and Length 2 = _____

   Is this answer (i) greater than (ii) less than (iii) equal to, Length 3?_____
4. Add Length 1 and Length 3 = _____

   Is this answer (i) greater than (ii) less than (iii) equal to, Length 2?_____
5. Add Length 2 and Length 3 = _____

   Is this answer (i) greater than (ii) less than (iii) equal to, Length 1?_____
6. What conclusion can you make about two sides of a triangle compared to the third side?

   Conclusion _____

   _____

Part 2

Discuss as a group, using your Geo strips as an aid to answer the following question.

Question. Two sides of a triangle measure 12 cm and 8 cm respectively. What is the range of values for the third side of the triangle.

Answer _____

Worksheet:
Are we ready for the distance formula?

1. Operations and Integers

Simplify:

(a) $-3+5$ (b) $-3-5$ (c) $-3+5$ (d) $-3-(-5)$

(e) $\frac{4}{2}$ (f) $\frac{-4}{2}$ (g) $\frac{4}{-2}$ (h) $\frac{-4}{-2}$

2. Squares

Simplify:

(a) $(5)^2$ (b) $(2)^2$ (c) $(-3)^2$ (d) $(-10)^2$

(e) $(-3+5)^2$ (f) $(8-(-2))^2$ (g) $(-3-4)^2$ (h) $(-12+4)^2$

3. Square roots

Simplify:

(a) $\sqrt{25}$ (b) $\sqrt{36}$ (c) $\sqrt{81}$ (d) $\sqrt{100}$

(e) $\sqrt{(4)^2}$ (f) $\sqrt{(-3)^2}$ (g) $\sqrt{(-4+6)^2}$ (h) $\sqrt{(2-(-2))^2}$

4. Substitution

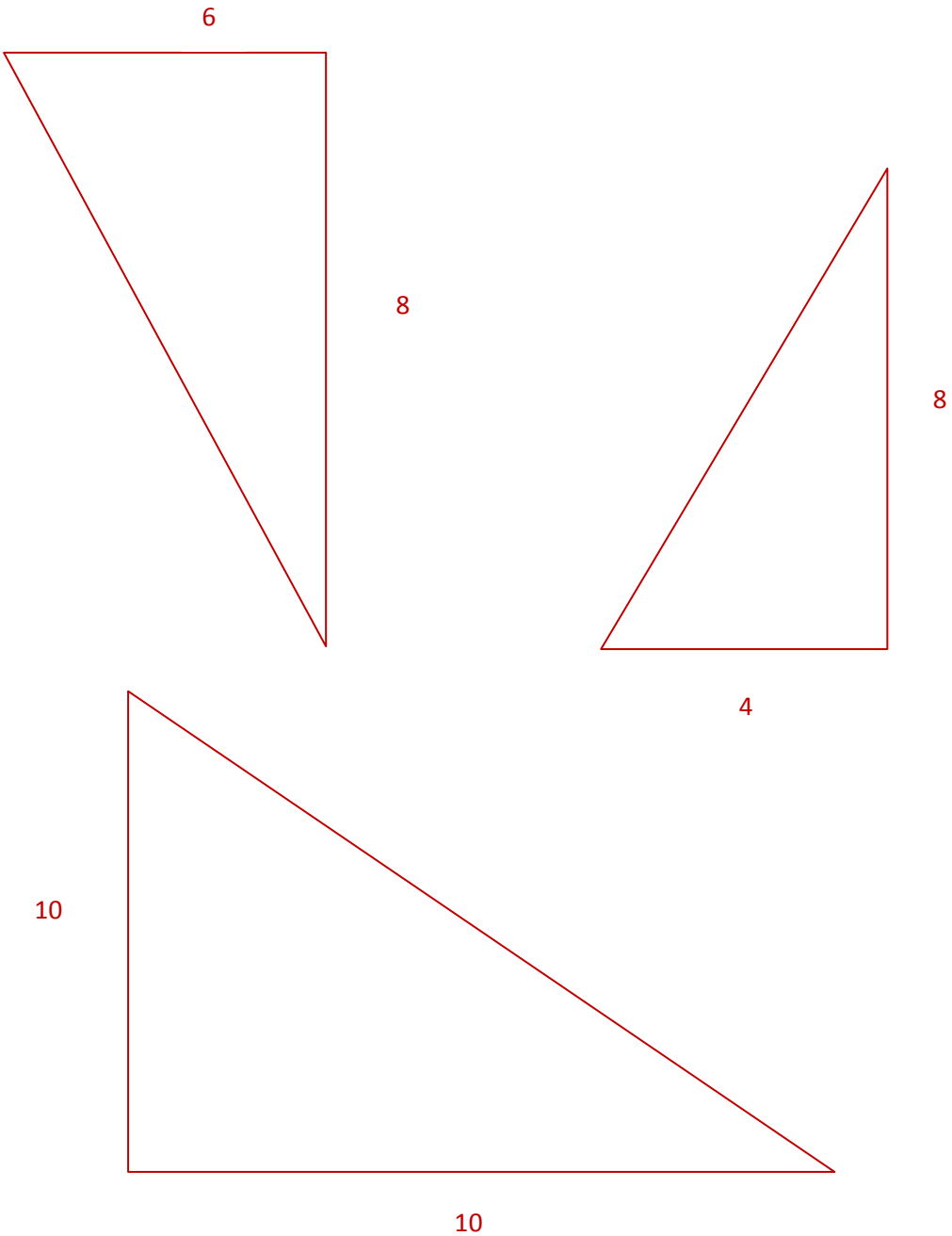
If $a = 2$ ans $b = -3$, find the value of each of the following:

(a) $a + 2$ (b) $b - 2$ (c) $a + b$ (d) $b - a$

(e) $a - b$ (f) $(b-a)^2$ (g) $(a - b)^2$ (h) $5 + (b-(b))^2$

5. Pythagoras' Theorem

By using Pythagoras' Theorem calculate the length of the unknown side in each of the following triangles to one place of decimal



Student Activity 1

Measuring Distances

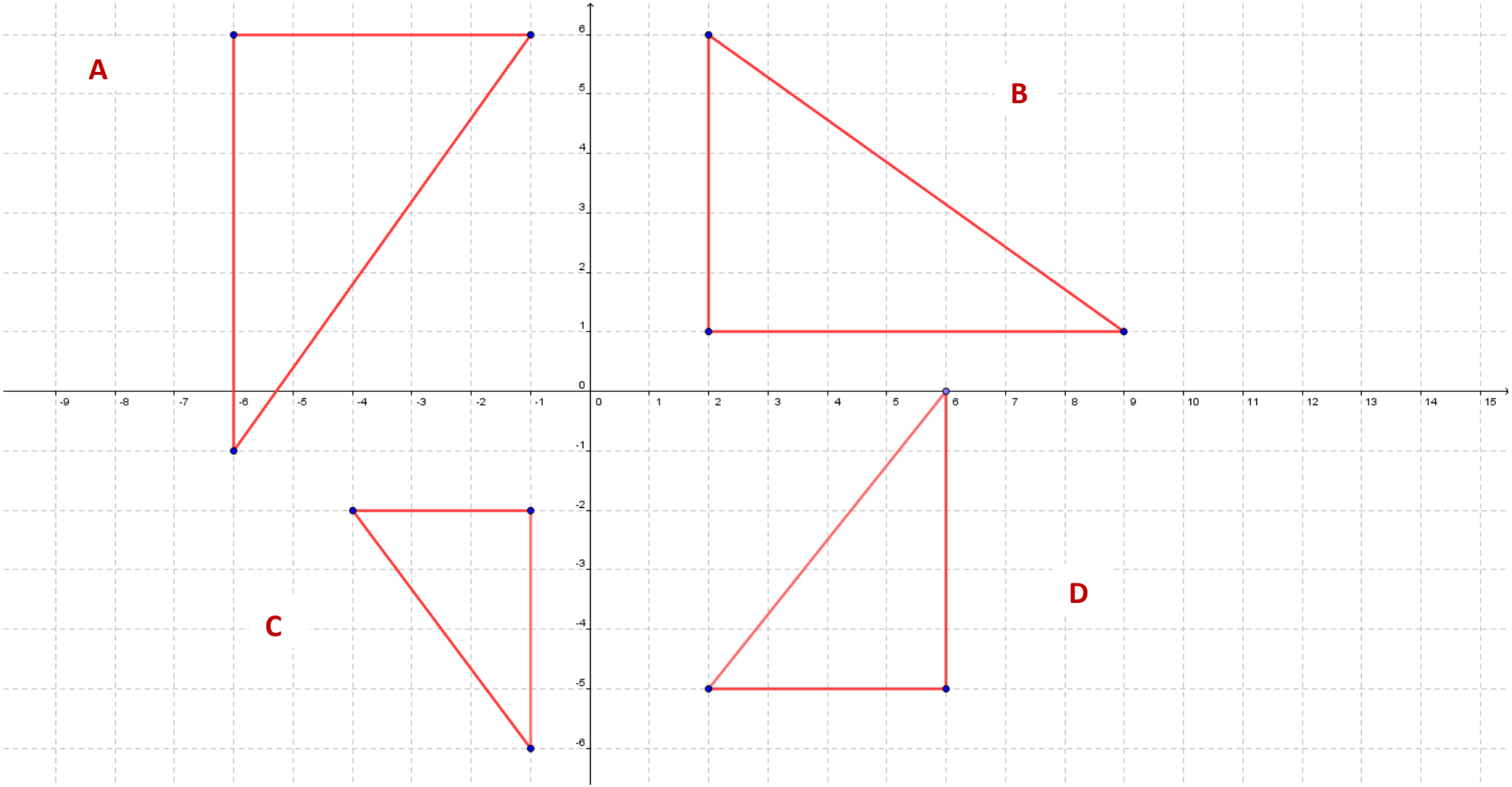
Distance	Instrument	unit
1. Length of a pen		
2. Length of a side of a desk		
3. The length of the classroom		
4. Length of school pitch		
5. School to your house		
6. Your house to nearest airport		
7. Your nearest Airport to Heathrow Airport, London		
8. Heathrow Airport to NASA Station, Houston, Texas		
9. Cape Carnaveral to International space station		
10. Earth to Neptune		

Student Activity 2

For each of the triangles A,B,C and D complete the following:

(i) using the scale, write the coordinates of each of the three vertices (ii) calculate the vertical distance (iii) calculate the horizontal distance

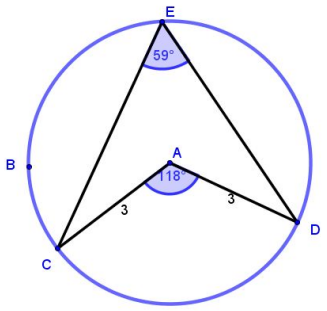
(iv) calculate the length of the hypoteneuse to two significant figures



Student Activity Theorem 19

Use in connection with interactive file "Theorem 19" on the Student's CD.

(Higher Level only)



1. Name the two line segments that are the radii of the circle. _____
2. Name the centre of the circle. _____
3. Move the point B around, what do you notice about the relationship between |AC| and |AD|? _____
4. Move the point D in the interactive file, so that the angle CAD is 120°.
   What is the measure of the angle CED? _____
5. Move the point D in the interactive file, so that the angle CAD is 140°.
   What is the measure of the angle CED? _____
6. Move the point D in the interactive file, so that the angle CAD is 80°.
   What is the measure of the angle CED? _____
7. Move the point D in the interactive file, so that the angle CED is 50°.
   What is the measure of the angle CAD? _____
8. Move the point D in the interactive file, so that the angle CED is 70°.
   What is the measure of the angle CAD? _____
9. What is the relationship between angle CAD and the angle CED?
   _____
10. Move B to the left and make the circle bigger, does the relationship between the angles CAD and CED change? _____Explain. _____

11. Move B to the right and make the circle smaller, does the relationship between the angles CAD and CED change? _____Explain. _____
_____

12. What can you conclude from the answers above?

    Conclusion _____

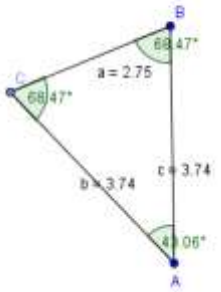
13. Click on the Tick Box on the interactive file to reveal the wording of this theorem.

    Did you come to this conclusion? _____.

Activity 1: To construct an isosceles triangle

1. In the View menu click on “Axes” to remove the x/y axes.
2. Select the  tool (circle with centre through a point) and construct a circle.
3. Select the  tool and construct any point on the circumference of circle.
4. Click the  dropdown menu and select the  tool. Join the three points to form a triangle.
5. Click  . Right click on one side of the triangle, select *Properties*, and with the Basic tab open, click on the drop down arrow beside the Show Label box. Select Name and Value to show the name and length of this side of the triangle. Repeat for the other triangle sides.
6. Drag each vertex of triangle and note the length of its sides.

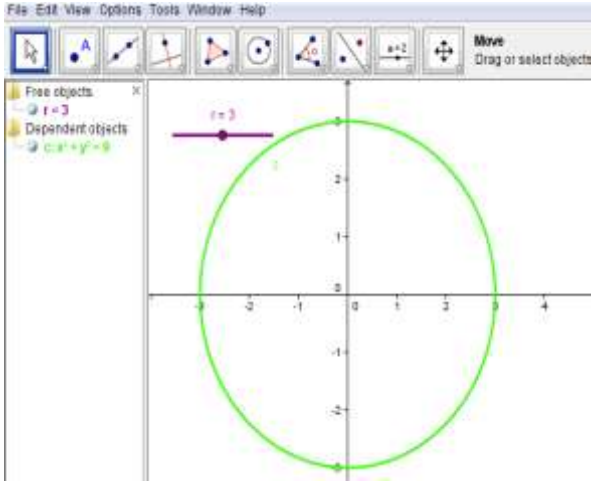
7. Hide the circle, by right clicking on it and clicking on *Show Object.*
8. Select the  tool and measure each angle by selecting the points in order.



9. If any of the angles are reflex, right click- properties and unclick “Allow reflex angle”.
10. Drag any of the vertices of triangle and observe how sides and angle measures change.

Activity 2: Use a slider to vary r and to investigate equations of the form $x^2 + y^2 = r^2$

1. Click on *File, New Window*
2. Select the  tool and click on the Drawing pad.
3. Type in r for the slider name and change the limits to 0 and 6.
4. Change the colour and thickness of the slider – right click – *Properties-Color-Style.* Type in **x^2+y^2=r^2** into the Input window at the bottom of the screen and press Enter. (*Note: to get ^ press shift and 6)*
5. Drag the slider to vary the value of r. What is the centre of all of these circles?
6. Click the  dropdown menu and select  and the circle to mark the centre.



Extension Exercise : Use sliders to vary h, k and r to investigate equations of the form $(x-h)^2 + (y-k)^2 = r^2$