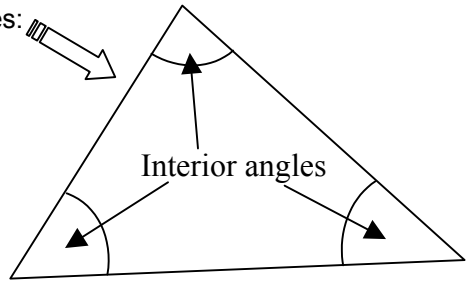
Trigonometry - Activity 1

Angle relationships: Sum of interior angles; Interior opposite angles

(a) Interior Angles of Triangles

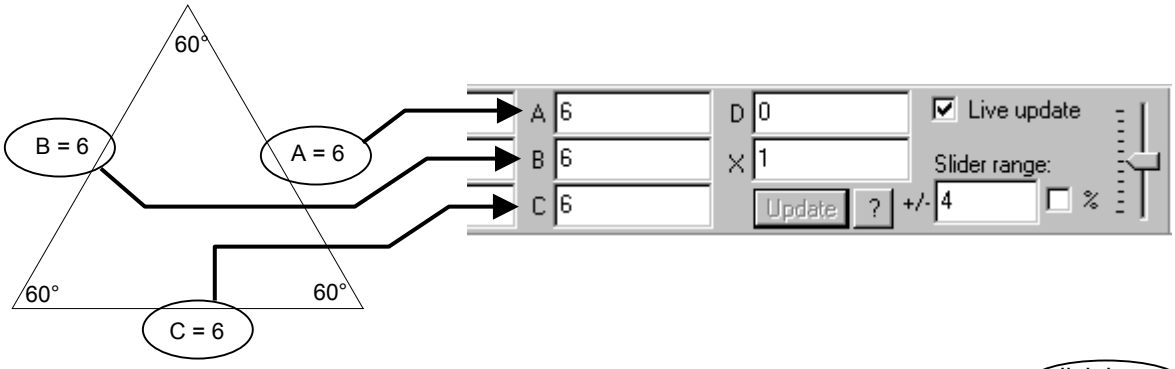
Every triangle has three interior angles:



You will measure and record the interior angles and their sum, for several different triangles.

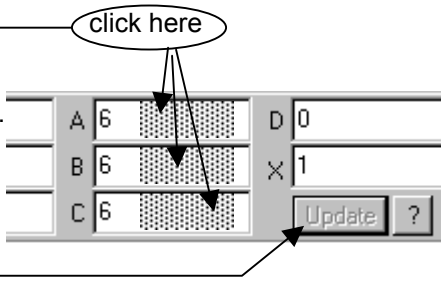
1) **Start Maths Helper Plus** and load the 'R2 - Angle relationships 1.mhp' document. The graph view will display a triangle.

2) Press the F5 key to **display the parameters box**. (See below.)
The values of 'A', 'B' and 'C' are the lengths of the three sides of the triangle:



3) **Change the length of the sides** of the triangle, like this:

Step 1: Click on the parameters box, on the right side of the value to be changed.
Step 2: Press the 'Backspace' key to delete the old value.
Step 3: Type the new value.
Step 4: Click the 'Update' button.



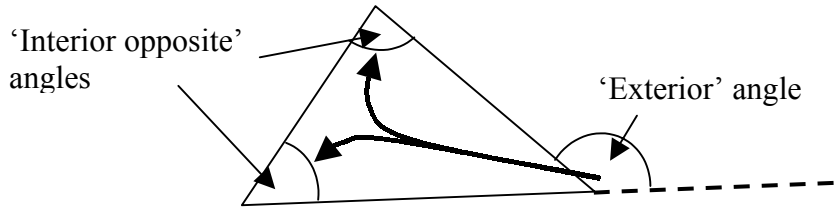
For each row of the table below, change the triangle sides to have the given lengths.
For each triangle you make, record the three interior angles in the table in any order. Use a calculator to add the three angles and record the sum in the last column.

Side 'A'	Side 'B'	Side 'C'	Angle 1	Angle 2	Angle 3	Sum of the three angles
6	6	6	60º	60º	60º	180º
3	6	6				
8	6	6				
10	6	6				
10	8	6				
10	15	6				
6	8	5				
6	8	11				
6	8	13				
6	8	14				

4) Complete this sentence: 'The sum of the interior angles of a triangle = _____'

(b) Exterior angle relationship

If any side of a triangle is extended beyond the triangle, an <u>exterior angle</u> is created:



How many exterior angles does a triangle have ? _____

For every exteror angle there are two <u>interior opposite</u> angles. (See diagram above.)

By measuring an exterior angle and its interior opposite angles for several different triangles, you will be able to demonstrate the relationship between these angles.

5) **Change the 'X' value** on the parameters box from '1' to '2'. This causes only the exterior angle and interior opposite angles to display.

6) For each row of the table below, **change the triangle sides** to have the given lengths.
For each triangle you make:

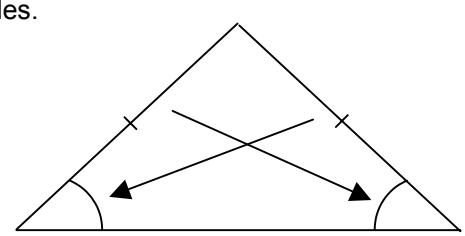
- record the exterior angle and the two interior opposite angles in the table.
- use a calculator to add the two interior opposite angles and record the sum in the last column.

Side 'A'	Side 'B'	Side 'C'	exterior angle	interior opposite angles		angle 1 + angle 2
				angle 1	angle 2	
6	6	6	120º	60º	60º	120º
3	6	6				
8	6	6				
10	6	6				
10	8	6				
10	15	6				
6	8	5				
6	8	11				
6	8	13				
6	8	14				

7. Write a sentence that describes the relationship between an exterior angle of a triangle and the sum of its interior opposite angles:

Trigonometry - Activity 2

Angle relationships: Isosceles and equilateral triangles.



(a) Angle Relationships in Isosceles Triangles

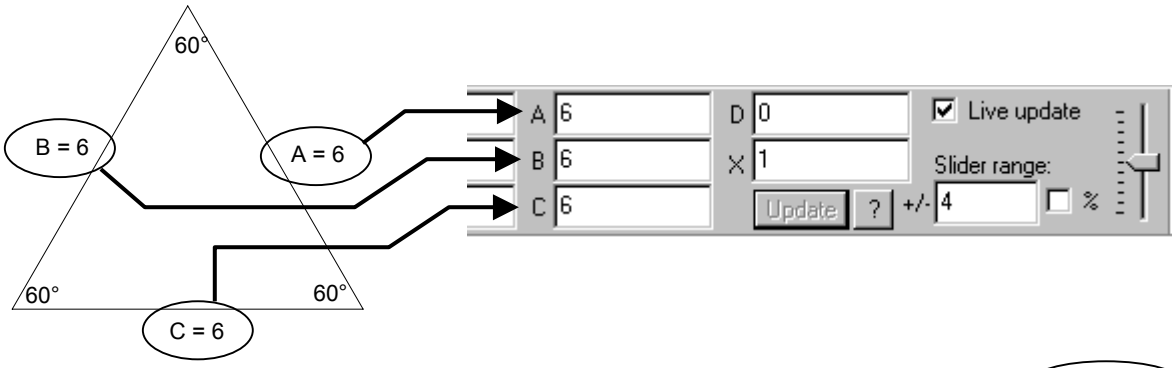
An isosceles triangle has two sides with the same length.

This diagram shows an isosceles triangle. The two equal sides are marked with short lines: / and the arrows point to the angles that are opposite to these sides.

You will create several different isosceles triangles, and record the angles that are opposite to the two equal sides.

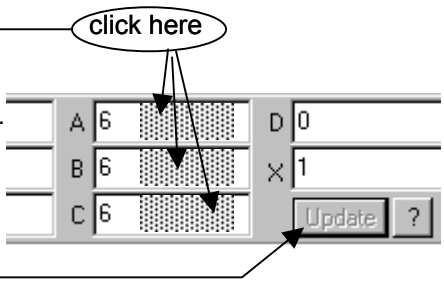
1) **Start Maths Helper Plus** and load the 'R2 - Angle relationships 2.mhp'

2) Press the F5 key to **display the parameters box**. (See below.)
The values of 'A', 'B' and 'C' are the lengths of the three sides of the triangle:



3) **Change the length of the sides** of the triangle, like this:

Step 1: Click on the parameters box, on the right side of the value to be changed.
Step 2: Press the 'Backspace' key to delete the old value.
Step 3: Type the new value.
Step 4: Click the 'Update' button.



Lines or angles that are exactly the same are said to be 'congruent'.
For each row of the table below, change the triangle sides to have the given lengths.
For each triangle you make, record the two angles that are opposite to the congruent sides.
(The first row has been done for you. See if you agree with the values for angle 1 and angle 2.)

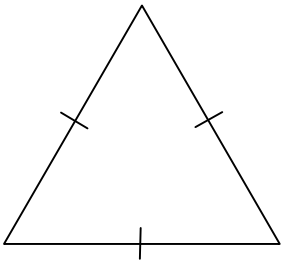
Side 'A'	Side 'B'	Side 'C'	Angle 1	Angle 2
7	7	6	64.6231°	64.6231°
10	10	6		
6	5	6		
9	5	9		
10	8	6		
10	6	10		
10	7	10		

4) Complete this sentence:

'If two sides of a triangle are congruent, the angles _____ those sides are _____'

(b) Angle Relationships in Equilateral Triangles

An equilateral triangle has three congruent sides:



You will create several different equilateral triangles, and record the three interior angles for each.

5) For each row of the table below, **change the triangle sides** to have the given lengths.
For each triangle you create, record the three interior angles in the table below:

Side 'A'	Side 'B'	Side 'C'	angle 1	angle 2	angle 3
5	5	5	60º	60º	60º
6	6	6			
7	7	7			
8	8	8			
10	10	10			

6) Complete this sentence:

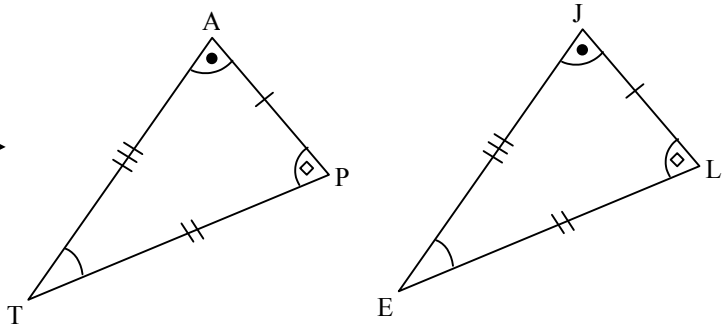
'An equilateral triangle has three c_____ angles of _____ degrees'

Trigonometry - Activity 3

Congruency: Naming corresponding sides and angles; Congruency statements.

Two triangles are said to be congruent if they have exactly the same size and shape. Every triangle has three interior angles and three sides, and for two triangles to be congruent, the sides and angles of one must be the same as the sides and angles of the other.

1) Start Maths Helper Plus and load the 'R2 - Congruency 1.mhp' document. The graph view will display two congruent triangles similar to these: →



On this diagram, congruent sides and angles have matching symbols.

The letters 'A', 'T', 'P', 'J', 'E' and 'L' identify the **vertices** of the triangles.

For congruent triangles, the vertices of one triangle are said to **correspond** to those in the other triangle.

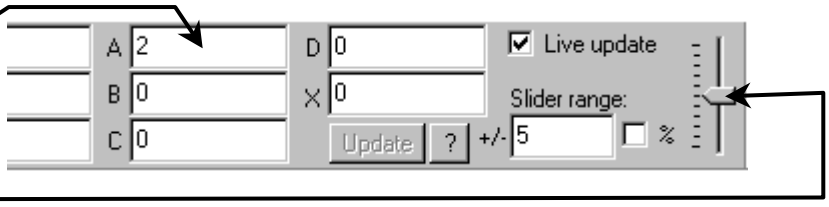
If the congruent triangles were overlaid on top of one another, then 'T' would be exactly on top of 'E'.
So 'T' corresponds to 'E'. This is often written like this: T ↔ E

2) Complete the following: A ↔ _____ L ↔ _____

To be sure that the triangles are congruent, we can overlay them on the screen.

3) Press the F5 key to display the parameters box. (See below.)

- Click on the 'A' edit box
- Click on the slider button



Use the up arrow and down arrow keys on your keyboard to move the right hand triangle so that it exactly fits on top of the left hand triangle.

Are these triangles congruent ? _____

Congruency notation: This symbol: ≅ means 'is congruent to'.

So to state that our two triangles are congruent, we can say: Δ T A P ≅ Δ E J L

When you state a congruency relationship, the letters must be in **corresponding order**. →

4) Check this on the triangles: Does 'T' ↔ 'E' and 'A' ↔ 'J' and 'P' ↔ 'L' ? _____

5) We can also write this congruency relationship with the letters in a different order, as long as they are still written in corresponding order.

Complete these statements: **(b)** Δ A T P ≅ Δ _____ **(b)** Δ _____ ≅ Δ L E J

Sides and Angles: Letters in corresponding order can also define sides and angles.

- **Two** letters for **sides**, eg 'AT'. (AT ≅ JE means: Side 'AT' is congruent to side 'JE'.)
- **Three** letters for **angles**, eg ∠PAT. (So: ∠PAT ≅ ∠LJE means: Angle 'PAT' is congruent to angle 'LJE')

6) Complete the statements of congruency below. In each case, study the triangles on your computer screen so that you get the vertices in corresponding order.

Sides:

(a) A P $\cong$ ____

(b) T P $\cong$ ____

(c) A T $\cong$ ____

(d) ____ $\cong$ E L

(e) ____ $\cong$ J E

Angles:

(f) $\angle ATP \cong \angle$ _____

(g) $\angle LEJ \cong \angle$ _____

(h) $\angle ELJ \cong \angle$ _____

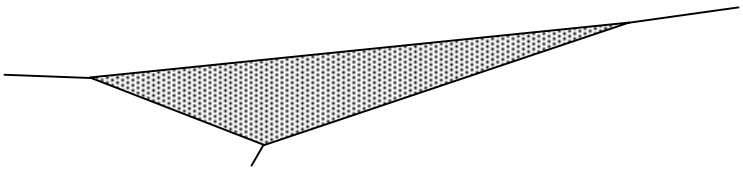
(i) $\angle$ _____ $\cong \angle PAT$

(j) $\angle$ _____ $\cong \angle TPA$

Trigonometry - Activity 4

Minimum conditions to establish congruency.

An architect has designed a triangular outdoor shade for a school play area, to be suspended by its corners:



This triangle has three sides and three interior angles. By choosing wisely, only three of these six values need to be specified in order to make sure that the shade is built correctly in the factory, but which three ?

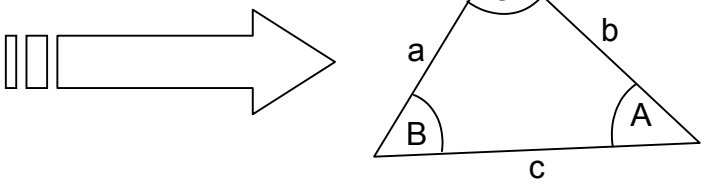
If a set of measurements can create more than one triangle, then the shade may be constructed incorrectly.

To solve this problem, we will list all of the possibilities, then eliminate the combinations that will not work.

A triangle has these six values:
(For simplicity, we will use capital letters for the angles, and little letters for the sides.)

angles: A, B, C

sides: a, b, c



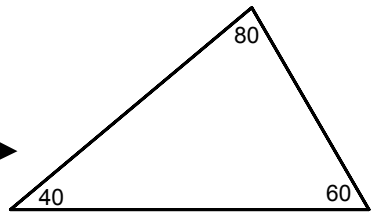
Here are the twenty possible sets of three values from this triangle. Similar combinations have been grouped:

Set of three measurements:	Description	Symbol
ABC	Three angles	AAA ☐
ABa, ABb, ABc, ACa, ACb, ACc, BCa, BCb, BCc,	Two angles and one side	AAS ☐
aBc, cAb, bCa	Two sides and the angle between the sides. (The included angle)	SAS ☐
abA, Bab, cbC, Bcb, acA, Cac	Two sides and an angle not between the sides.	ASS ☐ RHS ☐
abc	Three sides	SSS ☐

Investigation 1, Three angles, AAA

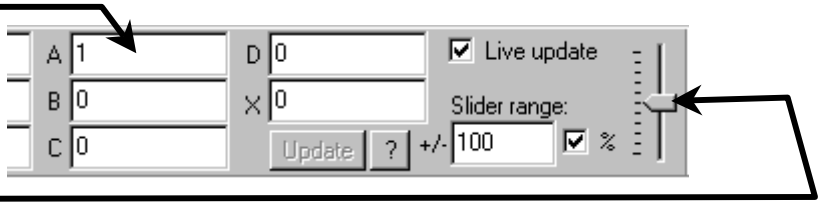
Are the three angles of a triangle sufficient information to construct a given triangle ?

1) Start Maths Helper Plus and load the 'R2 - Congruency 2.mhp' document.
The graph view will display this triangle:



2) Press the F5 key to **display the parameters box**. (See below.)

- Click on the 'A' edit box
- Click on the slider button



3) Press and hold the up arrow key
on the computer keyboard until the blue triangle stops enlarging.

4) The two triangles on your screen always have the same interior angles: 40, 60, 80. Would these three angles be enough information to build a triangular structure accurately ? _____ Why ?

5) Press and hold the down arrow key until the blue triangle is as small as possible, then use the up arrow key to return it to its original size.

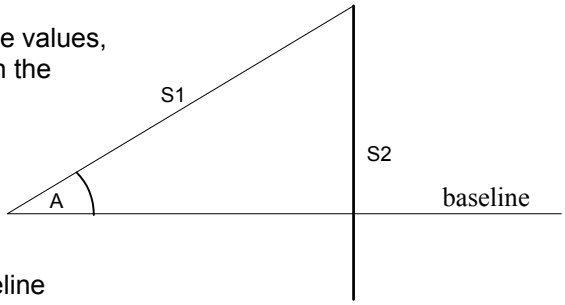
Put a cross: ☒ in the box near 'AAA' in the table on the front side of this sheet to indicate that two triangles do not have to be congruent just because their interior angles are congruent.

Investigation 2, Two sides and a non-included angle

If you knew only the lengths of two sides and one non-included angle, could you build the triangular structure accurately ? (Remember, a non-included angle does not lie between the two given sides.)

6) Load the 'R2 - Congruency 3.mhp' document. The graph view will display this diagram:

This is a triangle under construction. We have been given three values, the two sides S1 and S2, and one angle 'A' that is not between the two given sides.



This method has been followed so far:

(a) a horizontal baseline was drawn (see diagram)

(b) side S1 was added, making angle 'A' with the baseline

Now we are just about to add side S2 to join side S1 to the baseline. How many ways can we do this ?

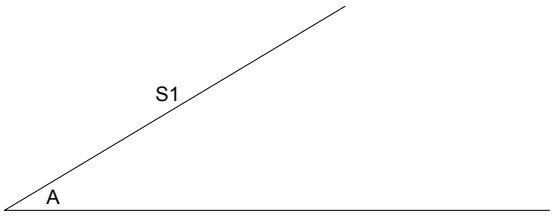
7) If the **parameters box** is not already displayed, press F5 to display it.

- Click on the 'B' edit box on the parameters box.
- Click on the slider button.

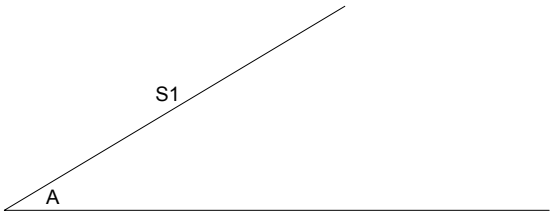
8) Use the up and down arrow keys on the keyboard to rotate side S2 so that it just meets the baseline. You should be able to make two different triangles.

Complete these diagrams by drawing side S2 in the two positions you found that can make a triangle:

Triangle 1



Triangle 2



Put a cross: ☒ in the box near 'ASS' in the table on the front side of this sheet to show that two triangles do not have to be congruent just because two of their sides and one non-included angle are congruent.

Investigation 3, For right triangles: Right angle, Hypotenuse and 1 other side

If side S2 is only just long enough to reach the baseline, then it will only meet the baseline at one point. S2 will then make a right angle with the baseline.

9) Set up the parameters box values:

- Click on the 'A' edit box on the parameters box. Press 'Backspace' to delete the '8' and type 5.
- Click on the 'B' edit box, Backspace and change the value to 90.
- Click on the 'slider button'.

The labels will change on the diagram. The right angle will be marked, the side 'S1' is now the hypotenuse, and so is called: 'H', and 'S2' is now called: 'S'.

10) Use the up and down arrow keys on your keyboard to rotate side 'S'. You will see that only one triangle is possible when side 'S' just touches the baseline.

Put a tick: ☑ in the box near 'RHS' in the table on the front side of this sheet to show that two right triangles have to be congruent if their hypotenuses and one other side are congruent.

11) All other combinations of 3 triangle measurements are sufficient to specify a unique triangle.

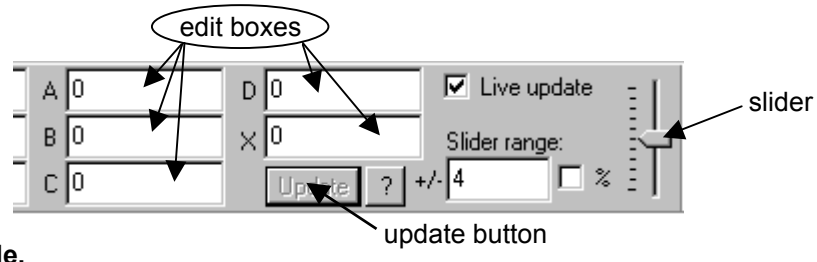
Put a tick: ☑ in all of the remaining boxes in the table on the front side of this sheet.

Trigonometry - Activity 5

Congruency: Practice writing congruency relationships for pairs of congruent triangles.

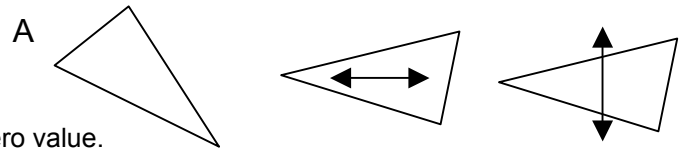
1) Start Maths Helper Plus and load the 'R2 - Congruency 4.mhp' document.
The triangle displayed on the graph view is really two congruent triangles superimposed. One triangle remains fixed, while you can move the other triangle to other positions.

2) Press the F5 key to **display the parameters box**. (See below.)



3) Learn to move the triangle.
You can move one of the congruent triangles by changing the numbers in the edit boxes of the parameters box. This is how the values affect the triangle:

- 'A' rotates the triangle.
- 'B' moves the triangle horizontally.
- 'C' moves the triangle vertically.
- 'D' flips the triangle horizontally if it has a non zero value.
- 'X' flips the triangle vertically if it has a non zero value.



To rotate or move the triangle, click on the edit box for the movement you want ('A', 'B' or 'C'), then drag the slider up and down with the mouse.

- **Try rotating and moving** the triangle.

To flip the triangle, click on the 'D' or 'X' edit box as required, then press the Backspace key to delete the old value. Now type '1' and click the 'Update' button. Change the value back to '0' to undo.

- **Try flipping** the triangle horizontally and vertically, then undo.

Hints for using the parameters box:
(a) Always click the edit box you want to change before dragging the slider.
(b) If you are dragging the slider and want finer control, use the up and down keyboard arrow keys.
(c) If the slider reaches the top or bottom but you want to go further, click on the edit box again.
(d) To enter a particular value, click on the edit box, change the value and then click 'Update'.

Now **return the triangle to its original position**.

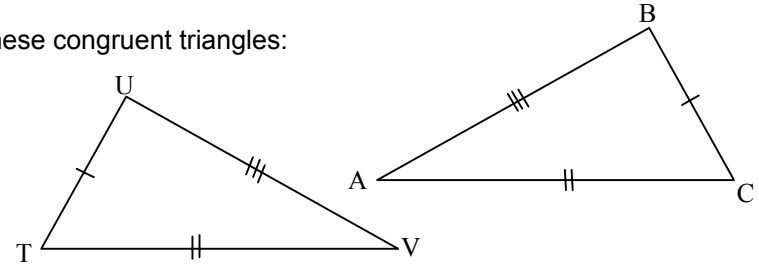
- To do this, click on each edit box, change the value to 0, then click Update.

Corresponding corners of the triangles have the same shaped markers drawn on them, and corresponding sides have the same colour.

4) For each pair of congruent triangles below, write the congruency relationship for the triangles, then use the moving triangle on your screen to duplicate the diagram and correct your answer.

(a) Complete the statement of congruency for these congruent triangles:

$\Delta UTV \cong \Delta$_____

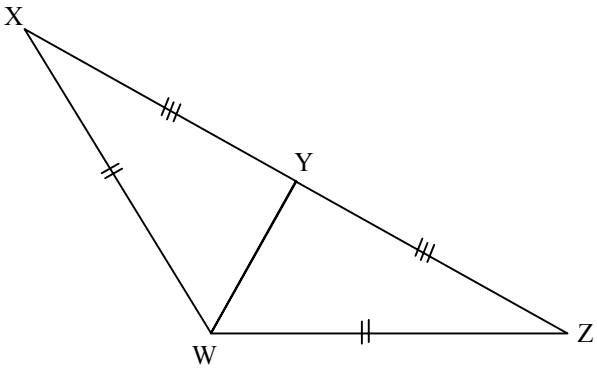


Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = 0, B = 2.88, C = 0.8, D = 1, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

(b) Complete the statement of congruency for these congruent triangles:

Δ Z W Y $\cong$ Δ _____

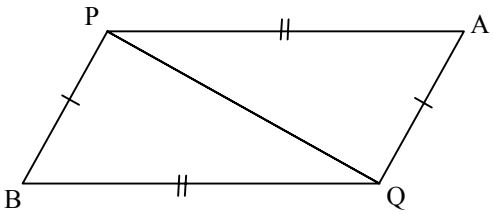


Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = 1.28, B = -1.92, C = 1.4, D = 1, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

(c) Complete the statement of congruency for these congruent triangles:

Δ P Q B $\cong$ Δ _____

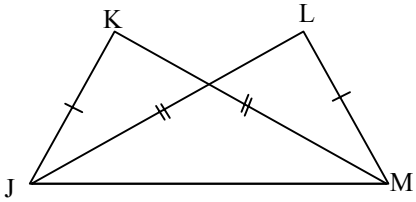


Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = -3.14, B = 3, C = 0.32, D = 0, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

(d) Complete the statement of congruency for these congruent triangles:

Δ M L J $\cong$ Δ _____

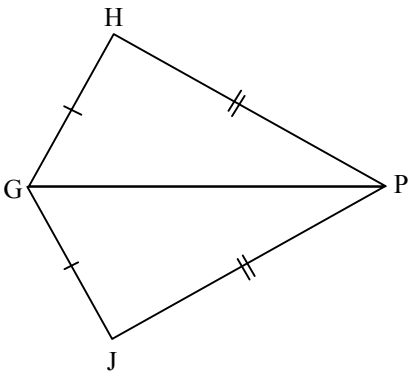


Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = 0, B = 0.96, C = -0.36, D = 1, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

(e) Complete the statement of congruency for these congruent triangles:

Δ P J G $\cong$ Δ _____



Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = 0, B = 0, C = -2.52, D = 0, X = 1
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

Trigonometry - Activity 6

Establishing congruency, and more practice writing congruency relationships for pairs of congruent triangles.

IMPORTANT: This activity assumes that you have completed at least the front side of 'Trigonometry Activity 5'.

Right angled triangles...

1) Start Maths Helper Plus and load the 'R2 - Congruency 5.mhp' document.
The right triangle displayed on the graph view is really two congruent triangles superimposed. One triangle remains fixed, while you can move the other triangle to other positions.

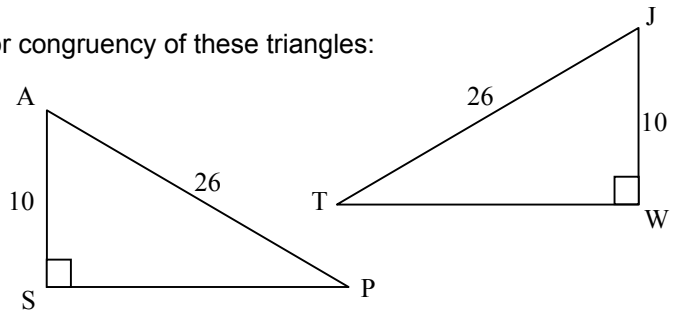
See 'Trigonometry Activity 5' to find out how to change the triangle position.

2) If not displayed already, press the F5 key to **display the parameters box**.

NOTE: Each of the following questions contains a pair of congruent triangles, however, when stating the reason for congruency in part (a) of the questions, base your reason only on details marked on the diagrams.

3) (a) Tick one of the following options as the reason for congruency of these triangles:

AAS ☐ SAS ☐ RHS ☐ SSS ☐



(b) Complete this statement of congruency

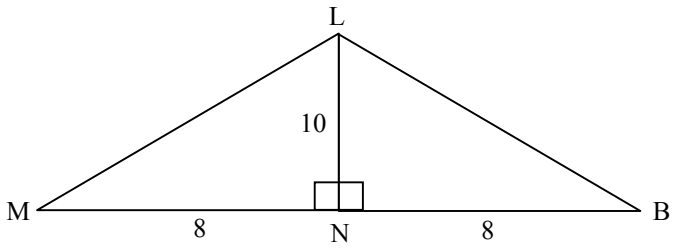
Δ A P S $\cong$ Δ _____

(c) Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = 0, B = 3.36, C = 2.4, D = 1, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

4) (a) Tick one of the following options as the reason for congruency of these triangles:

AAS ☐ SAS ☐ RHS ☐ SSS ☐



(b) Complete this statement of congruency

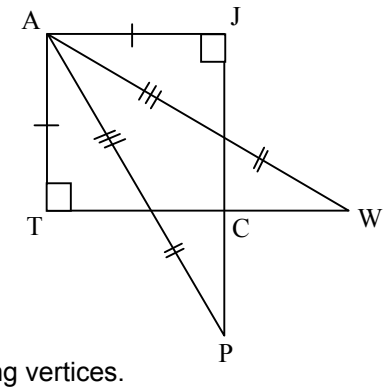
Δ L N B $\cong$ Δ _____

(c) Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values: A = 0, B = -4.28, C = -0.64, D = 1, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

5) (a) Find two congruent triangles in this diagram, then tick one of the following options as the reason for congruency:

AAS ☐ SAS ☐ RHS ☐ SSS ☐



(b) Complete this statement of congruency:

Δ _____ $\cong$ Δ _____

(c) Use Maths Helper Plus to correct your answer:

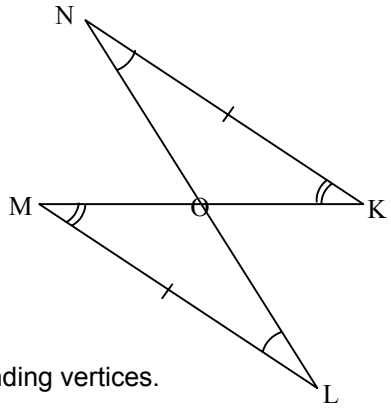
- Set up the moving triangle with these values:
  A = 1.57, B = 0.36, C = 0.64, D = 0, X = 1
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

Obtuse angled triangles...

Load the 'R2 - Congruency 6.mhp' document for obtuse angled triangles.

6) (a) Find two congruent triangles in this diagram, then tick one of the following options as the reason for congruency:

AAS ☐ SAS ☐ RHS ☐ SSS ☐



(b) Complete this statement of congruency:

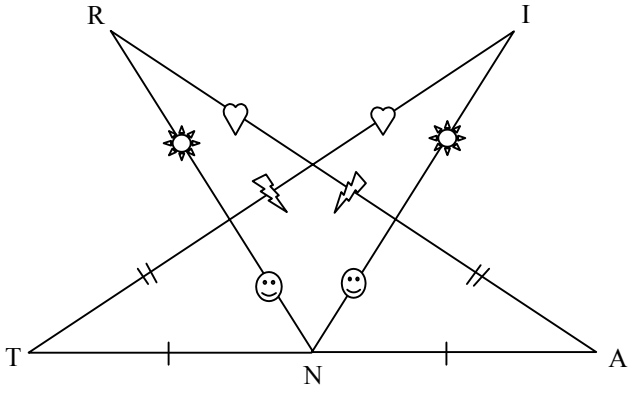
Δ _____ $\cong$ Δ _____

(c) Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values:
  A = 0, B = 0, C = -3, D = 1, X = 1
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

7) (a) Find two congruent triangles in this diagram with vertices at the letter names, then tick one of the following options as the reason for congruency. (Similar shapes indicate congruent lines.)

AAS ☐ SAS ☐ RHS ☐ SSS ☐



(b) Complete this statement of congruency

Δ _____ $\cong$ Δ _____

(c) Use Maths Helper Plus to correct your answer:

- Set up the moving triangle with these values:
  A = 0, B = -0.64, C = 0.64, D = 1, X = 0
- Follow the dotted lines between the triangles to find corresponding vertices.
- Compare with your answer and correct any mistakes.

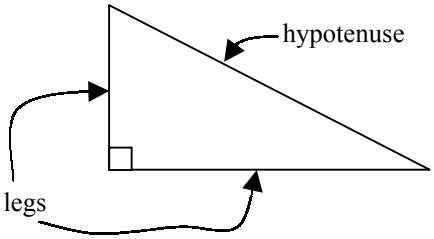
Name:_____ Class:_____

Trigonometry - Activity 7

Pythagoras: Visual demonstration of the rule; Pythagorean triples.

The rule of Pythagoras applies to right angled triangles. It can be used to find an unknown side of a right angled triangle, or to prove that a given triangle is right angled.

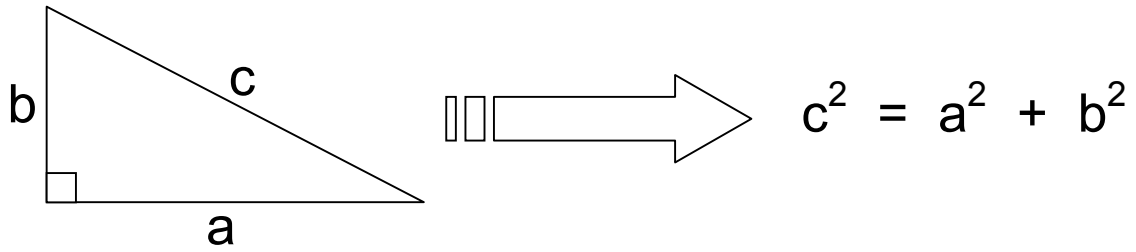
A right angled triangle, or 'right' triangle, contains a right angle: →



The longest side in a right angled triangle is called the 'hypotenuse'. The hypotenuse is always opposite to the right angle.

The two other sides are shorter than the hypotenuse, and are called 'legs'.

The rule of Pythagoras states that in any right angled triangle with legs 'a' and 'b' and hypotenuse 'c',

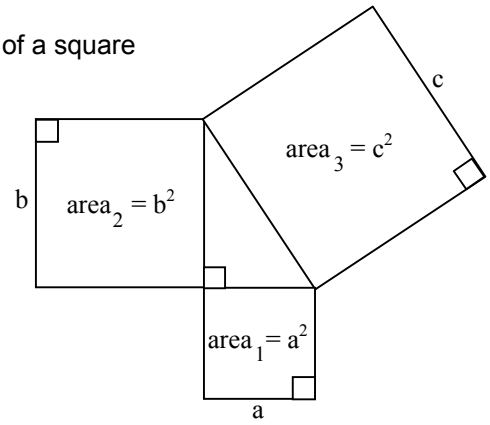


NOTE: It follows that for any triangle with side lengths 'a', 'b' and 'c', if $c^2 = a^2 + b^2$, then that triangle is a right angled triangle.

Part a: Demonstrating the rule of Pythagoras using areas.

To demonstrate the rule of Pythagoras we will use the fact that 'a^2' is the area of a square with side 'a', and similarly for 'b' and 'c'.

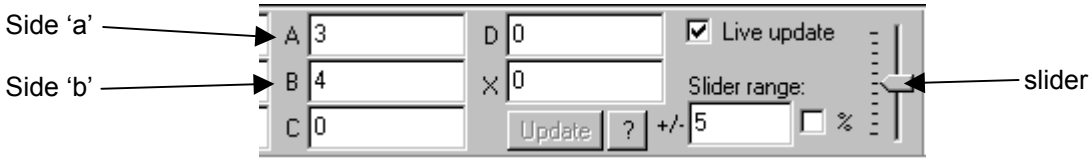
This diagram shows the sides and areas: →
It follows from the rule of Pythagoras that: **$area_3 = area_1 + area_2$**



You will now demonstrate the rule of Pythagoras using areas.

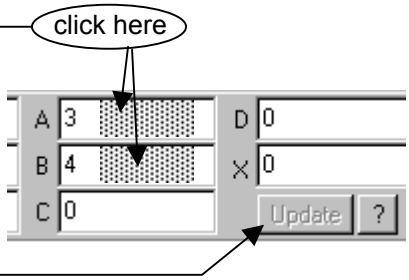
1) Start Maths Helper Plus and load the 'R2 - Pythagoras 1.mhp' document.
A right angled triangle diagram will be displayed.

2) Press the F5 key to **display the parameters box**. (See below.)
The values of 'A' and 'B' are the lengths of the two legs 'a' and 'b' of the right triangle:



3) Change the length of the legs of the triangle, like this:

Step 1: Click on the parameters box, on the right side of the value to be changed.
Step 2: Press the 'Backspace' key to delete the old value.
Step 3: Type the new value.
Step 4: Click the 'Update' button.



4) For each row of the table below:

(a) calculate a^2, b^2 and $a^2 + b^2$ without using the computer. Write these value in the table.

(b) enter the 'a' and 'b' values into the parameters box as shown above, and click 'Update'.

NOTE: **If the diagram becomes too big** for your computer screen, press the 'F10' key to reduce its size. To make the diagram bigger, hold down 'Shift' while you press 'F10'.

(c) correct your values of a^2 and b^2. Copy the 'c' and c^2 values from the computer screen to the table.

a	a^2	b	b^2	$a^2 + b^2$	c^2	c
3		4				
2		4				
5		3				
5		6				
6		1				

If the rule of Pythagoras is true, then the $a^2 + b^2$ and c^2 columns of the table should be equal. Check this.

Part b: Pythagorean Triples

A set of three integers: { a, b, c } is a 'Pythagorean triple' if $a^2 + b^2 = c^2$. Three integers will only form the lengths of the sides of a right angled triangle if they are a Pythagorean triple.

For example, { 3, 4, 5 } is a Pythagorean triple because $3^2 + 4^2 = 5^2$, so we can make a right angled triangle with these side lengths.

To see if three numbers are a Pythagorean triple:

(a) The two smallest numbers are 'a' and 'b'. Find the sum: $a^2 + b^2$ of the squares of the smallest two of the three numbers.

(b) The largest number is 'c'. Calculate c^2.

(c) If $a^2 + b^2 = c^2$ then the integers: { a, b, c } form a Pythagorean triple.

5) For each set of three integers in the table below,

(a) Write the 'a', 'b' and 'c' values in the table. (As long as 'a' and 'b' are the two smallest numbers, you can decide which number is 'a' and which is 'b'.)

(b) Calculate the values for the other columns of the table and write your answers in the spaces provided.

(c) If the $a^2 + b^2$ and c^2 values are the same, then these numbers are a Pythagorean triple. Write 'yes' in the last column of the table if this is true, or 'no' if it is false.

(d) Enter your 'a' and 'b' values into Maths Helper Plus as in question '4' above.

NOTE: **If the diagram becomes too big** for your computer screen, press the 'F10' key to make it smaller. To make the diagram bigger, hold down 'Shift' while you press 'F10'.

Check your values of a^2, b^2 and c^2 with those calculated by Maths Helper Plus.

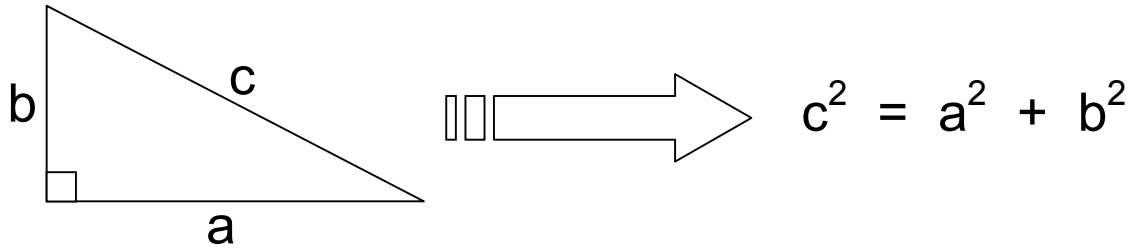
Set of integers	a	a^2	b	b^2	c	c^2	$a^2 + b^2$	Pythagorean Triple (yes/no)
3, 5, 4								
2, 3, 4								
13,5,12								
24,25,7								
11, 9, 4								
8, 15, 17								

Trigonometry - Activity 8

Pythagoras: Solving for unknown sides of right triangles.

In this activity, you will review the steps for finding unknown sides of right angled triangles using the rule of Pythagoras. You will then use these techniques to solve several triangle problems and use Maths Helper Plus to check you working steps.

The rule of Pythagoras states that in any right angled triangle with legs 'a' and 'b' and hypotenuse 'c',



This rule can be used (a) to find the hypotenuse, given the two leg lengths, or (b) to find an unknown leg length, given the other leg length and the hypotenuse.

This is how these problems can be solved:

(a) find the hypotenuse, 'c', given legs 'a' and 'b' of a right triangle.

Given: $c^2 = a^2 + b^2$,

so: $c = \sqrt{a^2 + b^2}$

For example, if 'a' = 3 and 'b' = 4,

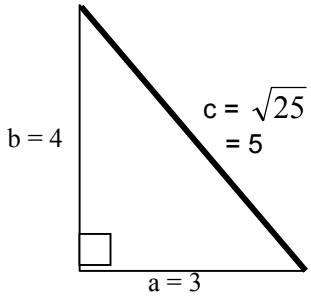
then $c^2 = 3^2 + 4^2$

$= 9 + 16$

$= 25$

so $c = \pm\sqrt{25}$

$= 5$ (Rejecting negative value of 'c'.)



(b) find leg, 'b', given leg 'a' and hypotenuse 'c' of a right triangle.

Given: $c^2 = a^2 + b^2$,

so: $b^2 = c^2 - a^2$

so: $b = \sqrt{c^2 - a^2}$

For example, if 'a' = 6 and 'c' = 10,

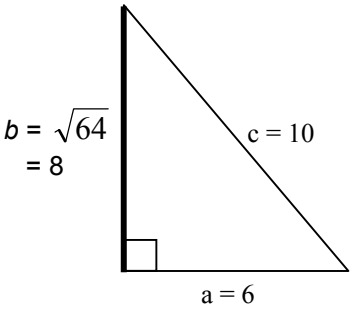
then $b^2 = 10^2 - 6^2$

$= 100 - 36$

$= 64$

so $b = \pm\sqrt{64}$

$= 8$ (Rejecting negative value of 'b'.)



Do steps 1, 2 and 3 below to practice using the Maths Helper Plus Pythagoras calculator:

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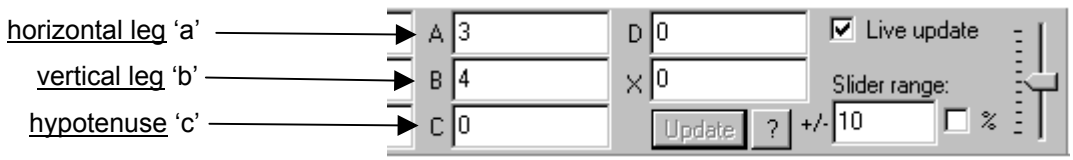
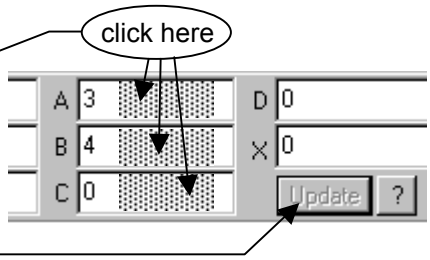
1) Start Maths Helper Plus and load the 'R2 - Pythagoras 2.mhp' document.
This document is a 'Pythagoras calculator', which displays the working steps and a labelled diagram for solving many right angled triangle problems.

2) Press the F5 key to **display the parameters box**:
These edit boxes: 'A', 'B' and 'C' are used to enter known values of 'a', 'b' and 'c':



3) Enter the two known side lengths, and set the unknown side length to zero.



Step 1: Click on the parameters box, <u>on the right side</u> of the value to be changed.
Step 2: Press the 'Backspace' key to delete the old value.
Step 3: Type the new value.
Step 4: Click the '<u>Update</u>' button.

NOTE: **If the diagram becomes too big** for your computer screen, press the 'F10' key to make it smaller.
To make the diagram bigger, hold down 'Shift' while you press 'F10'.

---

4) Solve these right angled triangles for the unknown sides. <u>For each triangle</u>:

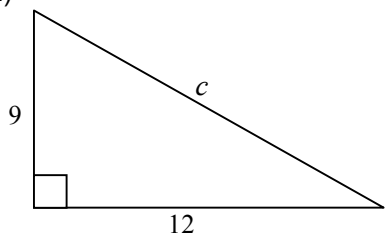
Calculate → **Check** → **Correct**

1. <u>Write</u> down the rule of Pythagoras,
2. <u>Substitute</u> the two known values,
3. <u>Calculate</u> the unknown side length.

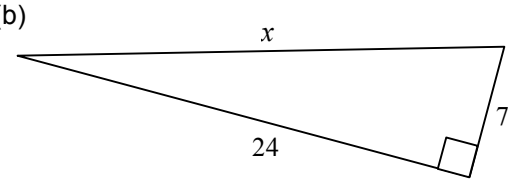
1. <u>Enter</u> the given side lengths into the Maths Helper Plus edit boxes.
2. <u>Set</u> the unknown side length to zero.

1. <u>Compare</u> your working and answers with Maths Helper Plus.
2. <u>Fix</u> your mistakes.

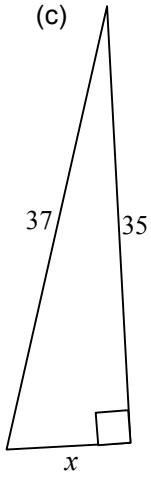
(a)



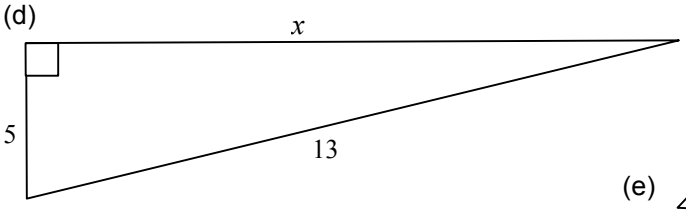
(b)



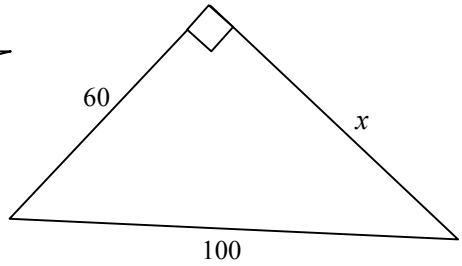
(c)



(d)



(e)



5) More right angled triangle problems
Each of the following questions can be solved by applying the rule of Pythagoras.

For each question:

Draw → **Identify** → **Label**

Draw a neat diagram of the situation in the question.

Identify the right angled triangle on your diagram and mark the right angle with a small box: 

Write the known side lengths on your diagram, then use a letter, such as '*x*', for the unknown side.

Then follow the same steps as in question 4: <u>Calculate</u>, <u>Check</u> and <u>Correct</u>.

(a) A trail bike rider travels 21 km due north, then 28 km due east. How far is she from her starting point ?

(b) A school science class attached a helium filled balloon to 61 metres of light fishing line. With the free end of the line tied to a tent peg on the school oval, the balloon was released. Eventually the balloon came to rest directly above a point on the oval 11 metres from the tent peg. Assuming the fishing line is pulled straight, calculate the height of the balloon above the ground.

(c) Advertised television screen sizes are the <u>diagonal</u> measurement to make them appear more impressive. On a television advertised as having a 51cm screen, the screen height is only 35 cm. What is the screen width ?
(Round your answer to the nearest centimetre.)

(d) In a military exercise, a submarine fired a long range torpedo. After firing, the submarine continued due west at a speed of 16 km / hr, while the torpedo travelled due south at 30 km / hr. How far was the torpedo from the submarine 30 minutes after firing ?