Level 2 – AS91259 – 3 Credits – Internal

**2.4 Use Apply Trigonometric Relationships**

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| **Achievement** | **Achievement with Merit** | **Achievement with Excellence** |
| Apply trigonometric relationships in solving problems. | Apply trigonometric relationships, using relational thinking, in solving problems. | Apply trigonometric relationships, using extended abstract thinking, in solving problems. |

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You may find the following formula useful:

**Triangles**

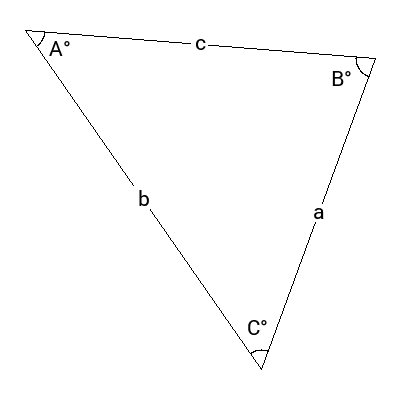
**Sectors**

# Notes from Lesson 1: Finding Area of Triangle

## Notes from Lesson 1.1: Introduction to Non-Right Angle Triangles

When we have a right angle triangle we label the sides using the lowercase letters a, b and c and we label the angles using uppercase letters A, B and C.

This gives us a triangle that looks like this:



## Notes from Lesson 2.2

To find the area of a triangle you use the formula: Area = ½ a b sin(C)

As you can see from the triangle below, a and b are the two sides, and C is the angle in between them.



Let’s look at an example:

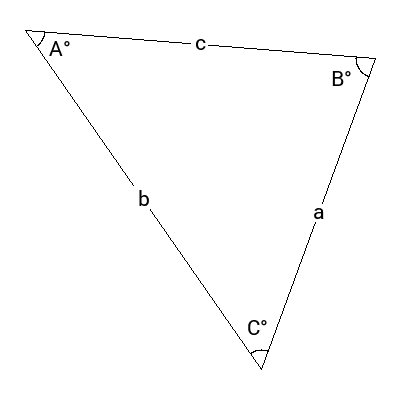


For this the formula is Area = ½ a b sin (C)

So… Area = ½ × 10 × 12 × sin(100) = 59.1m2 (don’t forget the units)

# Notes from Lesson 2: Cosine Rule to Find Side

Remember our triangle from before:



A really awesome formula is the cosine formula is:

We could write this as

Let’s look at an example with numbers



11.2m (3sf)

# Notes from Lesson 3: Cosine Rule to Find Angle

The cosine formula is:

We could write this as:

This lets us find out the angle in a triangle that is opposite the side we label c.

Let’s look at an example.



Note: when doing it on the calculator don’t forget to put extra brackets round the top and bottom lines of the fraction.

# Notes from Lesson 4: Sine Rule to Find Side

The sine rule is:

We could write the first two bits of this (the part without the cs) as:

And we can use this to work out the area of the second side.

Let’s look at this example:



Remember B is the angle that is opposite b, and A is the angle opposite a (the side we are trying to find out)

# Notes from Lesson 5: Sine Rule to Find Angle

The sine rule is:

We can write that up the other way as well:

We could write the first two bits of this (the part without the cs) as:

Let’s look at an example with numbers:



Remember B is the angle that is opposite b, and a is the side opposite A (the angle we are trying to find out)

# Notes from Lesson 6: Area of Sector

A sector is a cut of from a circle that looks like a piece of cake:

Now, we know the area of a circle is … therefore, the area of the part of the circle we are trying to find out is just whatever fraction of the area that the sector is a fraction of the circle.

So the area formula becomes

Because there are 360° in a circle and is the size of the angle.



Therefore the area is going to be

We could also work out the area using radians. There are 2π radians in a circle… so to convert from degrees to radians you and to go the other way you

This would mean the angle would be 1.379 radians.

When using radians the formula becomes

Therefore the area of our sector is

# Notes from Lesson 7: Arc Length of Sector

The arc length is how long the curvy bit of the sector is. This is again, just like last time, a fraction of the circle.

The formula for the circumference of a circle is

Therefore, the length of just the part that we are after is

where is the angle we have.

Let’s look at an example.



Arc Length =

Therefore, if we want to know the perimeter, we just add on the extra 5 on each of the other two sides so 5 + 5 + 5.93 = 15.93mm

Again, if we look at radians, we swap out the 360 in the formula with . This makes the formula:

This is because the two just cancel each other out.

For our example above, the angle would be 1.186 radians.

This would mean the arc length would be

# Lesson 9 – Investigation 1

*Note: this question isn’t self-marking… you’ll need to get your teacher to review what you’ve done.*

Stained glass windows are made by joining small pieces of glass together with lead. Simple windows are made with patterns of squares and diamonds. However there are no limits on the shapes in modern windows.

A diagram of part of the stained glass window in the local church is shown below. There is a vertical crack in the window from the top to the bottom. The local glazier has been asked to repair it.

To prevent further cracking, the church has requested that the window be cut into four sections of more than 0.1 m2, with at least one of the sections not a triangle.

You need to write a report describing how the window can be divided. To do this you will:

* find the length of the came required to repair the vertical crack
* demonstrate that the window can be divided into four sections of more than 0.1 m2 and show one possible way of doing this.

You need to clearly communicate your method using appropriate mathematical statements so that the glazier can easily verify the dimensions of the sections.

**Diagram of part of the stained glass window**

0.50 m

0.55 m

0.85 m

0.75 m

crack

85°

**Diagram not to scale**

Adapted from a task on TKI

# Lesson 9 – Investigation 2

*Note: this question isn’t self-marking… you’ll need to get your teacher to review what you’ve done.*

MathsNZ has designed a logo. They want to paint the logo on the wall outside the company office (they wish they had one of them) and have enough paint for 0.7 m2 of green, 0.9 m2 of blue and sufficient black paint for 6 m of edging.

**Task**

45°

45°

45°

1.2 m

2 m

The Maths NZ logo is a stylised symmetrical green letter M, set in a blue sector that is edged in black. The black outline goes around the outer edges of the sector. The three triangles that are cut out of the bottom of the M are all the same size.

Investigate the amount of paint required to paint the logo. Produce a report for the company that:

* gives the paint requirements of the current logo
* explains a way that the design can be altered so that no additional paint is required.

In order for your proposed adaptation to be favourably received by Absolute Adventures Company, it should not be radically different from the original design.

Include in your report relevant calculations and/or diagrams. Use appropriate mathematical statements to communicate your findings.

Adapted heavily from a task on TKI