

## Learning Activity 39: Medium Level Maths at Year 10

**Learning Behaviours:** Persisting, Getting Unstuck, Getting Started

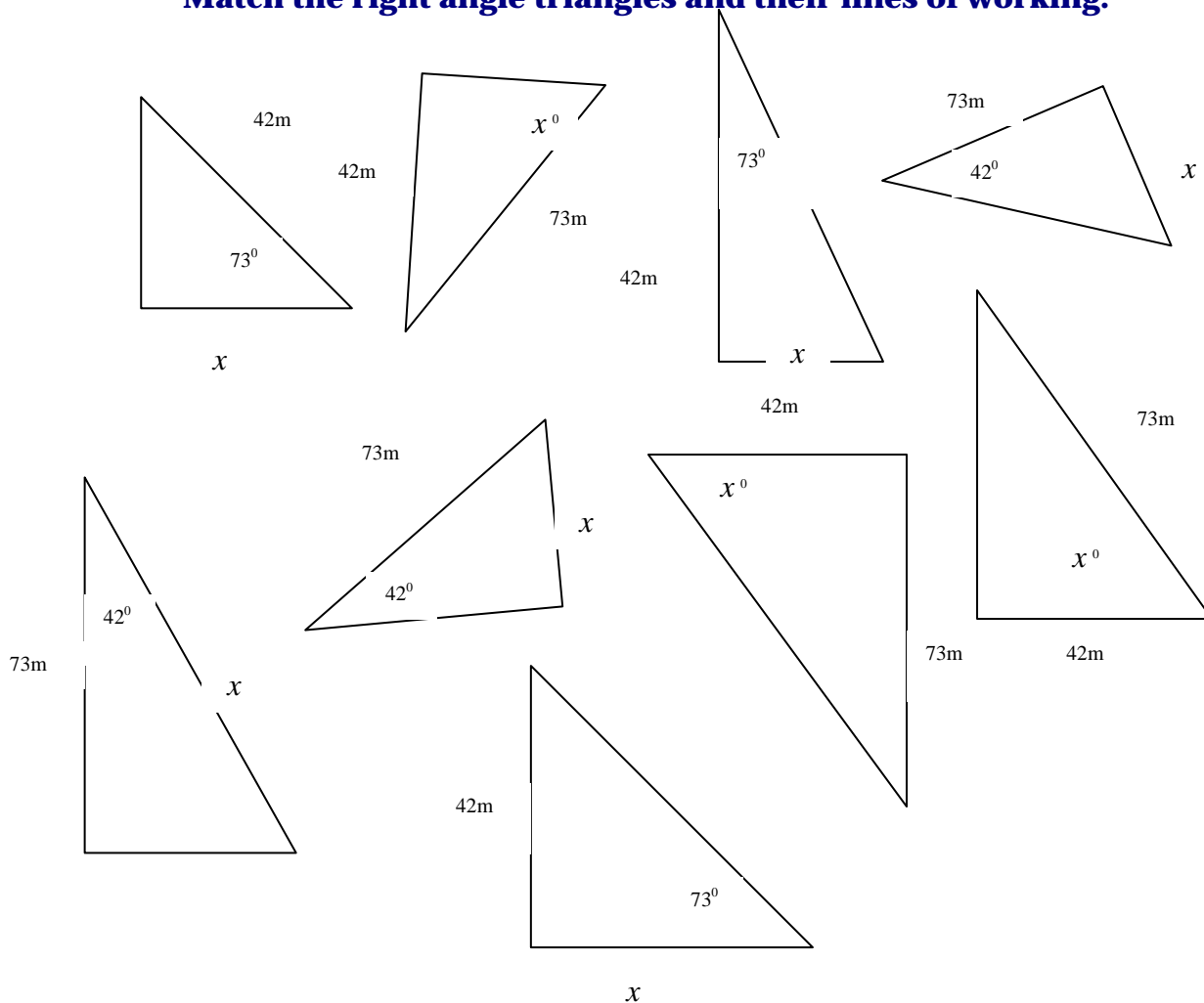
**Teacher:** BLK **DATE:** 25/4/06 **Class:** 10MAB

### Learning Activity Description

Jo and I had chosen the above learning behaviours to work on with a lower level maths group considering that these were an issue with most students in this level of mathematics and in the analysis exam and SAC questions in coming years. Trigonometry was the first topic and this lent itself to these types of problems. We presented students with tasks that required persistence eg. Match up below. We then worked on structures to support them in getting started and unstuck with analysis type questions by looking just at how to draw diagrams eg. Diagram Drawing. Then, on answering the whole question, by an assessment task – Trig Assessment Task which included emphasis on the ‘Steps to solve trig problems’.

I soon discovered that, through challenging these students to think at this high level, that there were many obstacles to overcome. Most of these were unrelated to mathematics but had impacted on their maths through previous years. I had originally chosen my Year 10 class to experience a more mature reflection and I thought it was time to test that. My discussion tool asked students to look at the bigger picture of their education and how maths fitted in to it.

### Match the right angle triangles and their lines of working.



1st lines of working

$$\tan 42 = \frac{x}{73} \quad \sin 42 = \frac{x}{73} \quad \tan x = \frac{73}{42} \quad \tan 73 = \frac{x}{42} \quad \cos 73 = \frac{x}{42}$$

$$\tan 73 = \frac{42}{x} \quad \sin x = \frac{42}{73} \quad \cos x = \frac{42}{73} \quad \cos 42 = \frac{73}{x}$$

### 2nd lines of working

$$\begin{array}{cccccc} \sin x = 0.5753 & 3.2709 = \frac{42}{x} & 0.6691 = \frac{x}{73} & 0.7431 = \frac{73}{x} & 3.2709 = \frac{x}{42} & \\ \cos x = 0.5753 & \tan x = 1.7381 & 0.9004 = \frac{x}{73} & 0.2924 = \frac{x}{42} & \sin x = 0.5753 & \end{array}$$

### 3rd lines of working

$$\begin{array}{cccccc} x = 65.73m & x = 137.38m & x = 60^\circ 5' & x = 48.85m & x = 12.28m & x = 73/0.7341 \\ x = 42/3.2709 & x = 54^\circ 52' & x = 35^\circ 7' & & & \end{array}$$

### 4th lines of working

$$x = 12.84m \quad x = 98.23m$$

### **Diagram Drawing**

Draw a diagram with everything on it you've been given and what unknown(s) you have been asked to find.

1. A plane leaves D and flies on a bearing of S65°W to G which is 685km away. How far west of D is G?
2. When on vacation, Kerri measured the angle of elevation to the top of a monument to be 64°. If she was standing 26.6m away from the base of the monument, find the height of the monument.
3. A 7.5m ladder is placed against a wall with the base 2.4m from the wall. Find the angle that the ladder makes with the wall.
4. A country road rises 57m for every 250m travelled along the road. At what angle is the road inclined to the horizontal?
5. A building 42.8m high casts a shadow 10.3m long. Find the angle of inclination the sun's rays make with the ground at this time of day.
6. A glider is directly above one end of the runway at a height of 430m. The pilot sees that the angle of depression to the other end of the runway is 29°. How long is the runway to the nearest metre?
7. A kite is flying at the end of a string 92m long. The string makes an angle of 55° with the ground. At what height is the kite flying?
8. A boy standing at a point P measures the bearing of a TV tower, H, to be N28°W. A distinctive tall tree, T, 4.9km due west of the boy is directly south of the tower. How far is it from the tower to the tree to the nearest metre?
9. Jane hiked from K to Z a distance of 16.9km in the direction of N78°E. She then hiked due south to a point B and due west back to K. How far did she hike?

10. A conveyor system is used to move boxes unloaded from trucks up into a storeroom. It can be set at any angle between  $15^{\circ}$  and  $50^{\circ}$ . If the length of the conveyor is 7m, what are the maximum and minimum heights the conveyor can reach?

11. A cone has a base diameter of 22cm and the length of the slant edge is 19.6cm. Find the height of the cone.

12. A ship travels on a bearing of  $052^{\circ}\text{T}$  so that it is 18 km EAST of its starting point. How far has it travelled on this bearing (use D)? How far is it to the north of its starting point (use N)?

13. A hiker walks 5km on a bearing  $\text{S}27^{\circ}\text{E}$  and then turns to a bearing of  $\text{S}59^{\circ}\text{E}$ . He now travels a further 10km. How far towards the east has he walked since starting?

### Steps to Solve Trig Problems

**A**

Do we use Sin, Cos & Tan?

**B**

Put the data into a general formula:

$$\sin \theta = \frac{O}{H}$$

$$\cos \theta = \frac{A}{H}$$

$$\tan \theta = \frac{O}{A}$$

**C**

Convert into or out of decimal degrees with the DMS button.

**D**

Find the angle using one of the INVERSE sin, cos or tan.

**E**

Solve for x: unknown is on the top.

**H**

Does it need other maths?

**G**

Draw a diagram including 'x' for what you have to find.

**F**

Solve for x: unknown side is on the bottom

**I**

Answer the question in a sentence with units.

### **Year 10 Assessment task Trigonometry Analysis Questions**

**Draw triangle diagrams for each question**

**LIST your steps (see sheet with A to I) to help you answer each question**

See criteria table to know what you will be marked on

You will be allowed to discuss in your table groups

**You will be allowed to ask your teacher 5 questions on this assignment.**

Criteria	Marks Allocated	Marks Given
Steps listed(A – I) for every question	4	
Diagrams well labelled and neat	6	
Choosing Sin, Cos or Tan	2	
Showing working for all the equations	6	
Units shown	2	
Number of questions completed	6	
Answering questions	2	
Correctness of answers	6	
<b>Total</b>	<b>34</b>	

### Question 1

Find the angle a 3.5m ramp makes with the horizontal if it is used to span a horizontal gap of 2m between a ferry and the wharf. Find also the perpendicular height between the wharf and the deck of the ferry.

### Question 2

A train travels due east from Dalton for 5km then due north for 7.5km to Eaglevale.

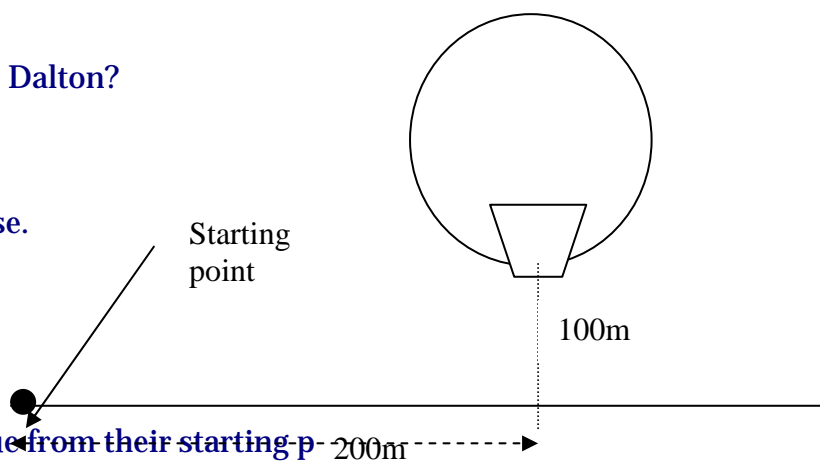
a) What is the bearing of Eaglevale from Dalton?

b) The train travels from Eaglevale due east for 7.2km and due south for 2.4km to Frenchmore. Find the bearing of Frenchmore from Dalton.

c) What is the distance from Frenchmore to Dalton?

### Question 3

Sue has organized a sightseeing trip in a hot air balloon for Kim as a birthday surprise. The balloon takes off and a short time later Kim and Sue are 100m in the air at a horizontal distance of 200m from the start.



a) Find the angle of elevation of Kim and Sue from their starting point.

b) The balloon now maintains its height and two minutes later its angle of elevation is  $18^\circ$ . Find the average speed of the balloon in m/s.

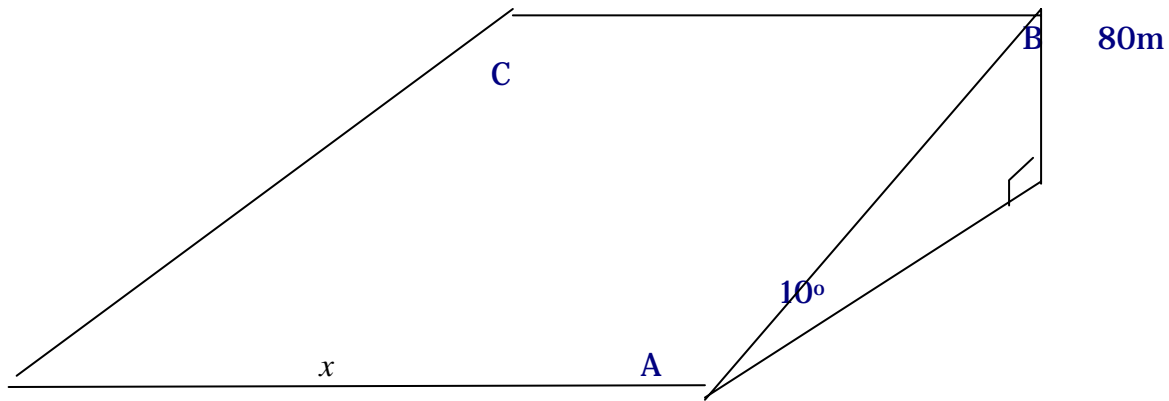
### Question 4

A hill is well modelled by the triangular prism shown. The hill has a height of 80m and a maximum slope of 10 degrees.

a) Find the shortest distance from the bottom to the top of the hill.

b) If the longest distance ( straight line AC) to the top of the hill is 608m, find  $x$ , the width of the hill to the nearest metre.

c) What is the angle of the gentlest slope one can walk in a straight line up the hill?



**Question 5**

A hiker walks for 15km on a bearing of 075°T then for a further 4 km on a bearing of 050°T. How far north of his starting point is he?

**Question 6**

A tent has the dimensions shown in the diagram. Find the area of the groundsheet needed to fit inside the tent.

**Discussion Tool:** Survey below

**How's Your Maths?**

1. What do you think are the reasons that you are in the medium level of maths in Year 10? (put 1 for most important down to whatever number is relevant)

- My basic maths is terrible eg. times table .....
- I had bad maths teachers .....
- I mucked around in Yrs 7 – 9 .....
- I couldn't get into the harder maths .....
- I hate maths .....
- I don't listen to explanations .....
- I can't be bothered with school .....
- I don't work hard enough .....
- I don't need maths for the job I want.....
- I give up if I can't do it .....

2. How much of the work did you understand last year (give yourself a mark out of 10)?

3. How much of the work do you understand this year (give yourself a mark out of 10)?

4. Explain the change in marks(is anything different):

5. Put in order from 1 to 6 what you think is important in studying maths under the Me column:

	<u>Me</u>	<u>BLK</u>	<u>Reality</u>
Being prepared (calculator, textbook, etc)	_____	_____	_____
Being organised (using planner, meeting deadlines)	_____	_____	_____
Working hard in class	_____	_____	_____
Maths skills are pretty good	_____	_____	_____
Doing homework	_____	_____	_____

Keeping on trying

6. Put in order under BLK from 1 to 6 what you think is important to me.

7. Fill in what I thought in the Reality column.

8. Explain any differences:

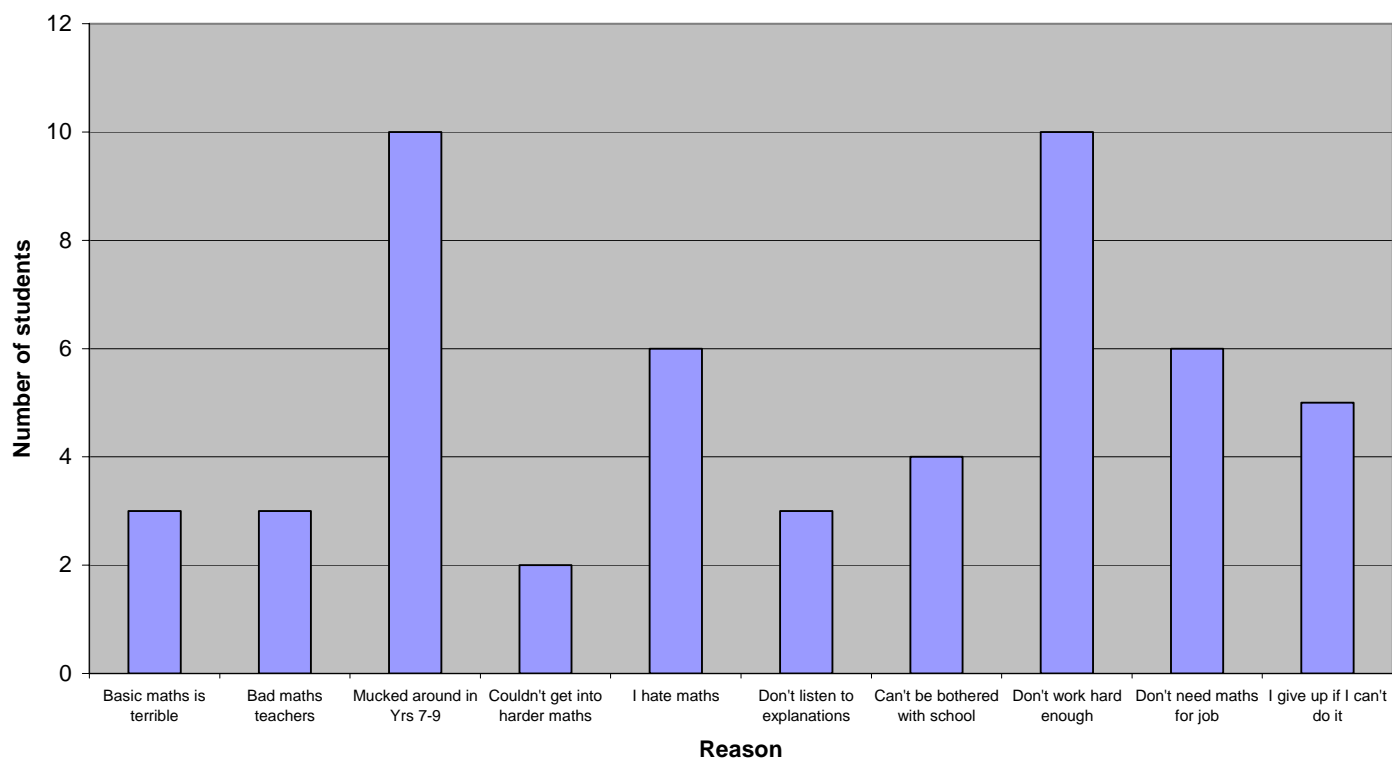
9. What is the main learning behaviour that you think that I have been trying to change in you?

10. Do you think that I can change your results and attitude to maths? YES NO

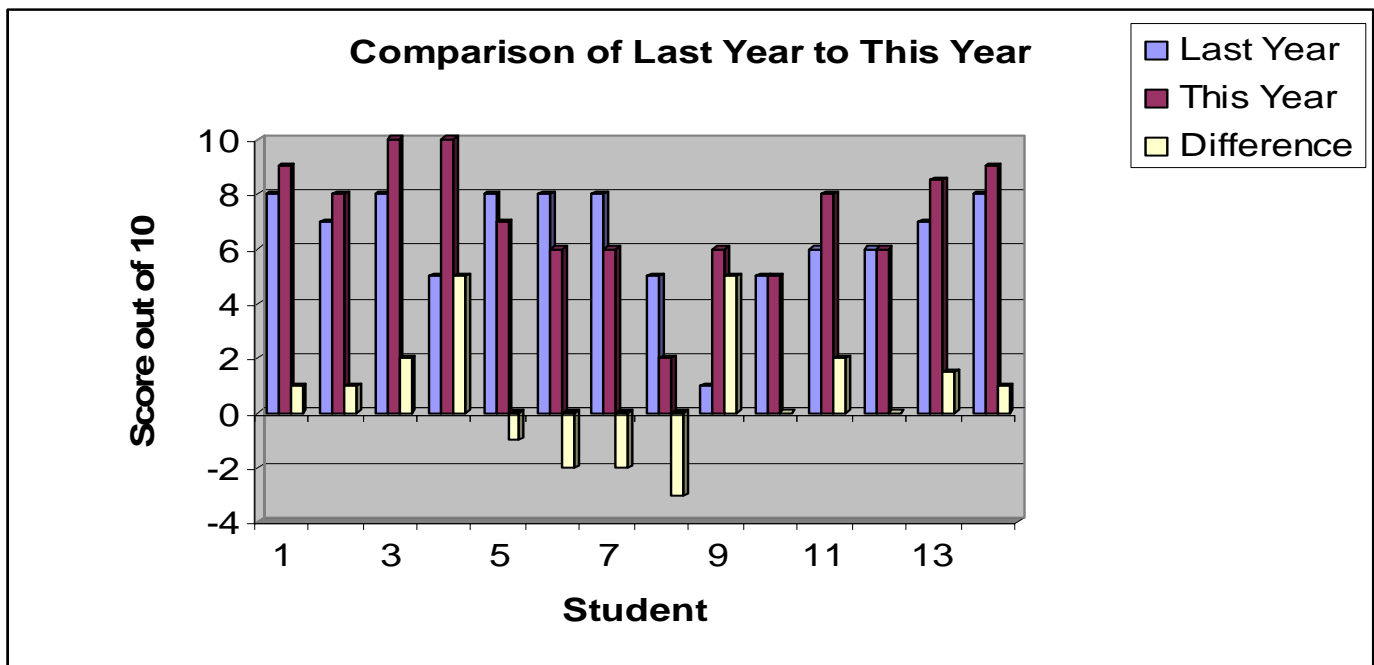
And why? \_\_\_\_\_

### Student Comments

Why are you in Medium Level Maths?



The graph supports my feeling that students' mathematical ability was not the main issue but "Mucking around in Yrs 7 – 9" and "I don't work hard enough". The latter is what I have been trying to address.



This showed that the students in general felt they understood maths better this year than previous years with few negative differences. I felt that this could be accounted for not just by the improvement in work ethic but it could also be a result of classes being streamed for the first time at Year 10.

In answer to the main learning behaviour that they thought I have been trying to change:  
 “concentrating”

“to show working and to be a bit more positive”

“keep trying, don’t give up”

“organisation/listening/homework”

I was pleased that there was a variety in these answers as I felt that I had really tried a multi-faceted approach.

In answer to whether I can change their results and attitude to maths, it was a clear majority who replied Yes.

“You already have. I’ve been trying my hardest.”

“I am not doing so bad in maths, so my attitude has already changed from last year.”

There were some emphatic Nos! These were a worry but would be in a medium level class that had several students choose that they hated maths as being a reason for being in this class.

“Plain and simple, I hate it.”

“Because my attitude to maths won’t change.”

And some general comments about some of the strategies I had used eg. complaints about seating plans!

After the survey, I collated the results(as shown above) and decided to present the above to the class after exams and the semester’s work had been completed. I wanted students to see the evidence of where they’d started the semester and where they’d finished.

### Teacher Journal

- It has been interesting for me, who usually teaches the highest stream of maths, to tackle a class with universal issues about their maths. This quickly became, in my mind, bad learning behaviours in general.
- I firstly made the classroom structure to get them working – tablegroups, separating out students who were off-task. Ringing parents about missing work.

- I remained positive about their mathematical ability, kept their interest by presenting work in a variety of ways – puzzles, activities, textbook, computer.
- Jo and I kept our standards high in terms of what we thought students could do. We felt a real pressure from students to ‘dumb down’ the curriculum in some areas, particularly the analysis questions. We held firm and kept trying different techniques to boost their understanding.
- The survey was excellent feedback to me as a teacher. It provided many insights to how the students were thinking and what were the blockers. I got some positive feedback on what I had tried during the first term and that their attitudes had changed in most cases.
- I am going to continue with the second and third point above. I am going to continue to build students’ belief in being able to achieve in mathematics. I am going to offer extended work to the more capable students and keep showing them the pathways they can take with maths from here.