Mathematics

Year 9
Below satisfactory

WORK SAMPLE PORTFOLIO

Annotated work sample portfolios are provided to support implementation of the Foundation – Year 10 Australian Curriculum.

Each portfolio is an example of evidence of student learning in relation to the achievement standard. Three portfolios are available for each achievement standard, illustrating satisfactory, above satisfactory and below satisfactory student achievement. The set of portfolios assists teachers to make on-balance judgements about the quality of their students' achievement.

Each portfolio comprises a collection of students' work drawn from a range of assessment tasks. There is no pre-determined number of student work samples in a portfolio, nor are they sequenced in any particular order. Each work sample in the portfolio may vary in terms of how much student time was involved in undertaking the task or the degree of support provided by the teacher. The portfolios comprise authentic samples of student work and may contain errors such as spelling mistakes and other inaccuracies. Opinions expressed in student work are those of the student.

The portfolios have been selected, annotated and reviewed by classroom teachers and other curriculum experts. The portfolios will be reviewed over time.

ACARA acknowledges the contribution of Australian teachers in the development of these work sample portfolios.

THIS PORTFOLIO: YEAR 9 MATHEMATICS

This portfolio provides the following student work samples:

Sample 1	Measurement: Trigonometry
Sample 2	Measurement: Wheelchair access (Pythagoras' Theorem)
Sample 3	Measurement: Tall and short (volume of a cylinder)
Sample 4	Geometry: Similar triangles
Sample 5	Probability: Probabilities
Sample 6	Number: Index laws
Sample 7	Algebra: Linear relationships
Sample 8	Measurement: Volume of a prism
Sample 9	Measurement: Surface area and volume
Sample 10	Statistics: Data displays
Sample 11	Measurement and geometry: Trigonometry and similarity in right-angled triangles
Sample 12	Statistics: Academy Awards
Sample 13	Geometry: Similarity

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This portfolio of student work shows the application of the index laws to numbers and expresses numbers in scientific notation (WS6). The student finds the distance between two points on the Cartesian plane, the gradient and midpoint of a line segment and sketches linear relationships (WS7). The student recognises the connection between similarity and trigonometric ratios (WS11) and uses Pythagoras' Theorem (WS2) and trigonometry to find unknown sides in right-angled triangles (WS1, WS11). The student uses measurement, ratio and scale factor to calculate unknown lengths in similar figures (WS4, WS11, WS13). The student calculates the volumes of right prisms (WS8) and the volumes and surface areas of cylinders (WS3, WS9). The student interprets and represents data in back-to-back stem-and-leaf plots and frequency histograms (WS10, WS12) and makes sense of the position of the median to compare skewed and symmetric sets of data (WS12). The student calculates relative frequencies to estimate probabilities, lists outcomes for two-step experiments and assigns probabilities for those outcomes (WS5).

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Measurement: Trigonometry

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students solve problems involving simple interest. They interpret ratio and scale factors in similar figures. Students explain similarity of triangles. They recognise the connections between similarity and the trigonometric ratios. Students compare techniques for collecting data in primary and secondary sources. They make sense of the position of the mean and median in skewed, symmetric and bi-modal displays to describe and interpret data.*
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> *Students apply the index laws to numbers and express numbers in scientific notation. They expand binomial expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment. They sketch linear and non-linear relations. Students calculate areas of shapes and the volume and surface area of right prisms and cylinders. They use Pythagoras' Theorem and trigonometry to find unknown sides of right-angled triangles. Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes. They construct histograms and back-to-back stem-and-leaf plots.*

Summary of task

Students had completed a unit of work on the trigonometric ratios. They were given a quiz to be completed as a class test during a lesson.

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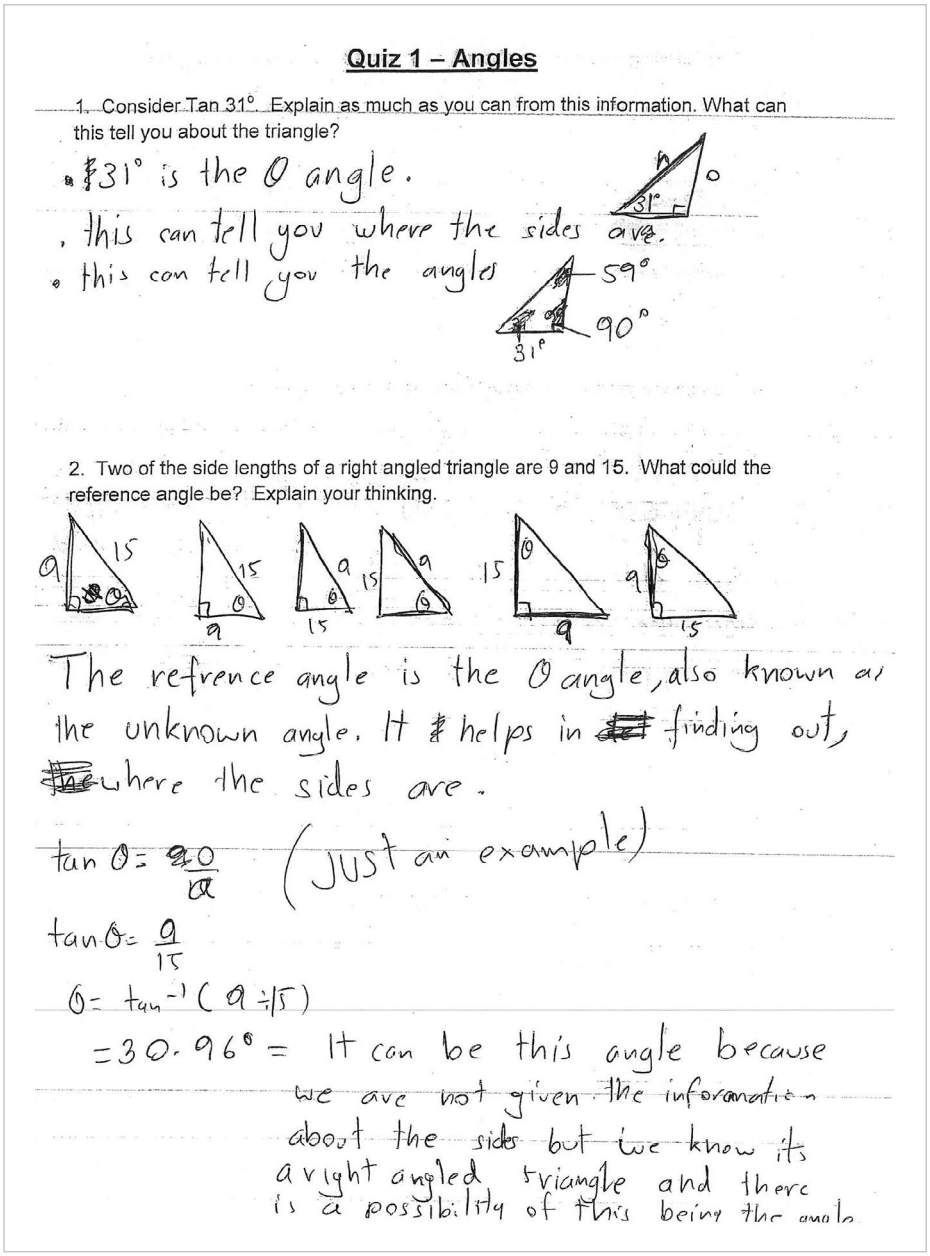
Measurement: Trigonometry



Quiz 1 – Angles

1. Consider Tan 31°. Explain as much as you can from this information. What can this tell you about the triangle?

• 31° is the θ angle.
• this can tell you where the sides are.
• this can tell you the angles

2. Two of the side lengths of a right angled triangle are 9 and 15. What could the reference angle be? Explain your thinking.

The refrence angle is the θ angle, also known as the unknown angle. It helps in finding out, where the sides are.

$\tan\theta = \frac{9}{15}$ (just an example)

$\tan\theta = \frac{9}{15}$

$\theta = \tan^{-1}(9 \div 15)$

$= 30.96°$ = It can be this angle because we are not given the information about the sides but we know its a right angled triangle and there is a possibility of this being the angle

Annotations

Makes general statements about the information contained in the triangle. Calculates the complementary angle in the triangle and labels the diagram with the information.

Draws and labels the sides of a variety of right-angled triangles but does not recognise that the hypotenuse must be longer than the other two sides.

Demonstrates understanding of the use of the tangent ratio.

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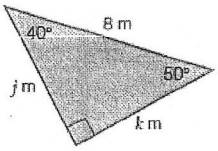
Measurement: Trigonometry

Quiz 2 – Sides

1. The following answers were given by a student on a trigonometry test.

i. Find the value of k.



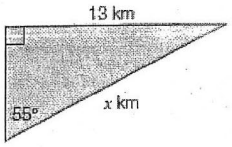
$\cos\theta = \frac{A}{H}$

$\cos 40° = \frac{k}{8}$

$8 \times \cos 40° = k$

$k = 6.13$ m

ii. Find the value of x.



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

$\sin 55° = \frac{13}{x}$

$13 \times \sin 55° = x$

$x = 10.65$ km

a) Explain the mistake the student has made in each question.

i) the student was suppose to use sin because with 40°, the k* becomes the opposite.

$\sin 40° = \frac{k}{8}$

SOH CAH TOA

ii) The studen was suppose to divide the third step. $13 \div \sin(55° = x$

since the ~~value~~ number is ~~the~~ or the top.

b) Show the correct calculations and answers.

i) $\sin\theta = \frac{O}{A}$

$\sin 40° = \frac{k}{8}$

$8 \times \sin(40° = 5.14$m

$k = 5.14$ m

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

$\sin 55° = \frac{13}{x}$

$13 \div \sin(55 = x$

$x = 15.87$ km

Annotations

Identifies the mistakes and provides correct alternatives.

Uses trigonometry to find unknown sides of right-angled triangles solving both for the hypotenuse and another side.

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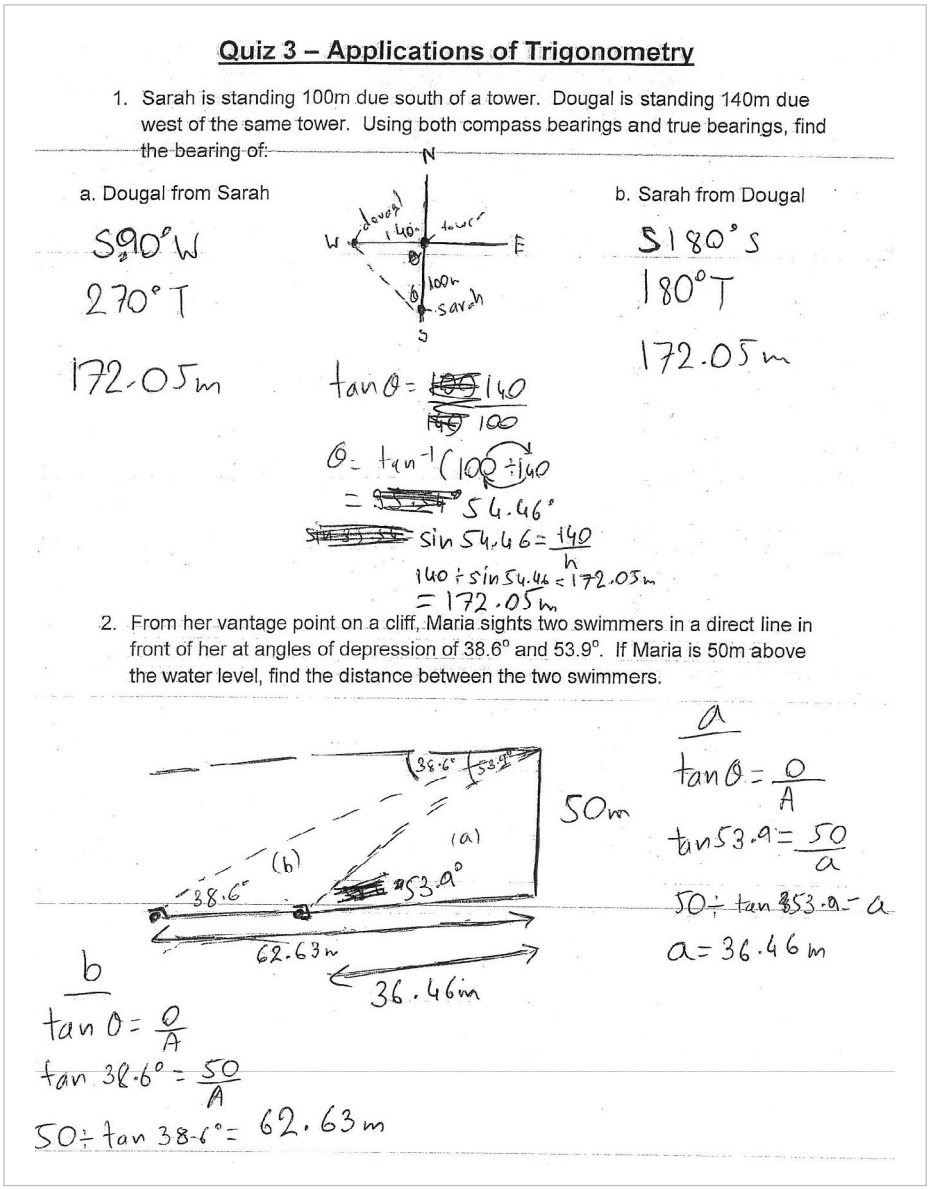
Measurement: Trigonometry



Quiz 3 – Applications of Trigonometry

1. Sarah is standing 100m due south of a tower. Dougal is standing 140m due west of the same tower. Using both compass bearings and true bearings, find the bearing of:

a. Dougal from Sarah

S90°W

270°T

172.05m

b. Sarah from Dougal

S180°S

180°T

172.05m

$\tan\theta = \frac{140}{100}$

$\theta = \tan^{-1}(100 \div 140)$

$= 54.46°$

$\sin 54.46 = \frac{140}{h}$

$140 \div \sin 54.46 = 172.05m$

$= 172.05m$

2. From her vantage point on a cliff, Maria sights two swimmers in a direct line in front of her at angles of depression of 38.6° and 53.9°. If Maria is 50m above the water level, find the distance between the two swimmers.

a

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

$\tan 53.9 = \frac{50}{a}$

$50 \div \tan 53.9 = a$

$a = 36.46m$

b

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

$\tan 38.6° = \frac{50}{A}$

$50 \div \tan 38.6° = 62.63m$

Annotations

Draws diagram showing information.

Calculates an appropriate angle but does not use this to determine the required bearings.

Calculates each distance but does not find the distance between the two swimmers.

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Year 9

Below satisfactory

Measurement: Wheelchair access (Pythagoras' Theorem)

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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Summary of task

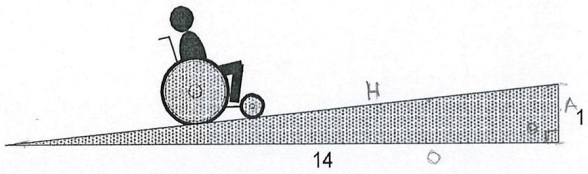
Students had completed a unit of work on Pythagoras' Theorem. They were given a worksheet with questions relating to Australian Standards Council regulations for slopes of ramps into buildings. Students completed the task as a class test during a lesson.

Measurement: Wheelchair access (Pythagoras' Theorem)

23. Wheelchair Ramps, Slopes and Accessibility

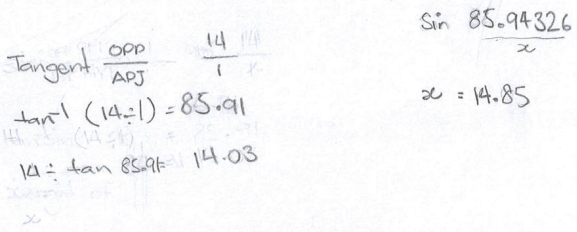
The Australian Standards Council has regulations for slopes of ramps into buildings, in order for wheelchairs to be accessible to the buildings. Such ramps must have no greater slope than 1 in 14.

By the term "1 in 14", we mean that for every 14 metres travelled horizontally (not actually on the ramp), we rise 1 metre. (The diagram below is not to scale.)



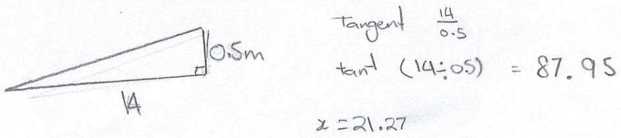
Use this information to answer the following question:

1. If a person effectively rises 1 metre vertically in moving along a 1 in 14 ramp, what is the length of the ramp? Please explain your working.

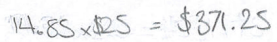


2. You have been asked to work out the size and cost of a ramp for accessibility to a portable classroom at a school. The ramp must rise by a total of 0.5 m.

a) What would be the minimum length of such a ramp?



b) If the ramp is 1.5 m wide, and non-slip materials used in making the ramp cost $25 per square metre, what will be the cost of the non-slip surface of the ramp? Once again, please show your working.



Annotations

Uses trigonometry to find the angle of inclination but is unable to take this approach further to answer the question.

Attempts to solve problem by drawing a new triangle but makes no connection to triangle used in question 1 and ratios.

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Measurement: Tall and short (volume of a cylinder)

Year 9 Mathematics achievement standard

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Summary of task

Students had completed a unit of work on surface area and volume. They were given a worksheet pertinent to this topic and asked to complete it without assistance during a lesson.

Measurement: Tall and short (volume of a cylinder)

20. "Tall and Thin" or "Short and Fat"

By taking appropriate measurements and carrying out calculations, answer the following question:

Which would hold the most:

- a cylinder made from an A4 sheet of paper, rolled so that it is "tall and thin";

  OR

- a cylinder made from an A4 sheet of paper, rolled so that it is "short and fat".

Please calculate the capacity in each case, show all your working, and then answer the question: "which would hold the most?"

Tall and thin = } Both same size just differently
short and fat = } shaped/or constructed.

"which would hold the most?"

The cylinders would both hold the same amount.

Annotations

Assumes solids produced using the same area of paper must have the same volume.

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Geometry: Similar triangles

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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Summary of task

Students had been investigating the concepts included in the study of similar triangles. They were given the task of measuring the angle of elevation of some common objects around the school, and worked in pairs to complete a short worksheet using the measurements to make a series of measurements and calculations.

Geometry: Similar triangles

Task: Work in pairs

1. Use the clinometers to measure the angles of elevation of 4 objects around the school. Eg basketball stand, flagpole, street light, building, tree, football goal posts. ***Record the angles.*** Each person is to choose 4 objects that are **different from their partner's** objects.
2. Measure the distance from where you were standing to the base of the object whose angle of elevation you measured. ***Record the distances.***
3. Measure your own height from floor to eye level. ***Record the height.***
4. In the classroom, draw four right-angled triangles, each with a base length of 5 cm and an angle that corresponds to each of the angles of elevation that you measured outside.
5. Calculate the height of each object using the similar triangles

Object	Angle of elevation	Distance to object
Flag Pole	54°	5m
Light pole	64°	5.2m
Short lamp	29°	11m
Sign	20°	3.20m

Your height to eye level
165 cm

What to hand in:

1. This sheet with your measurements included.
2. **Introduction** – a paragraph to explain what you are doing or finding out in this D.I. and how you went about the task.
3. **Mathematical procedures** – all diagrams and calculations.
4. **Analysis** – answer the questions below in well-written sentences.
   - Why did you have to measure your height?
   - List 3 ways in real life that this similar triangle procedure would be useful.
5. **Conclusion** – a paragraph to explain what you found out, where you could have made mistakes and how these mistakes could have been avoided.

- ❖ Communication – is your work easily understood, do your sentences make sense and have no spelling or grammar mistakes?
- ❖ Presentation – is your work neat and tidy? Are your diagrams large enough with names and labels? Are all your calculations clearly set out including formula used and working out done?

Annotations

Records angles of elevation, own height and distances as measured.

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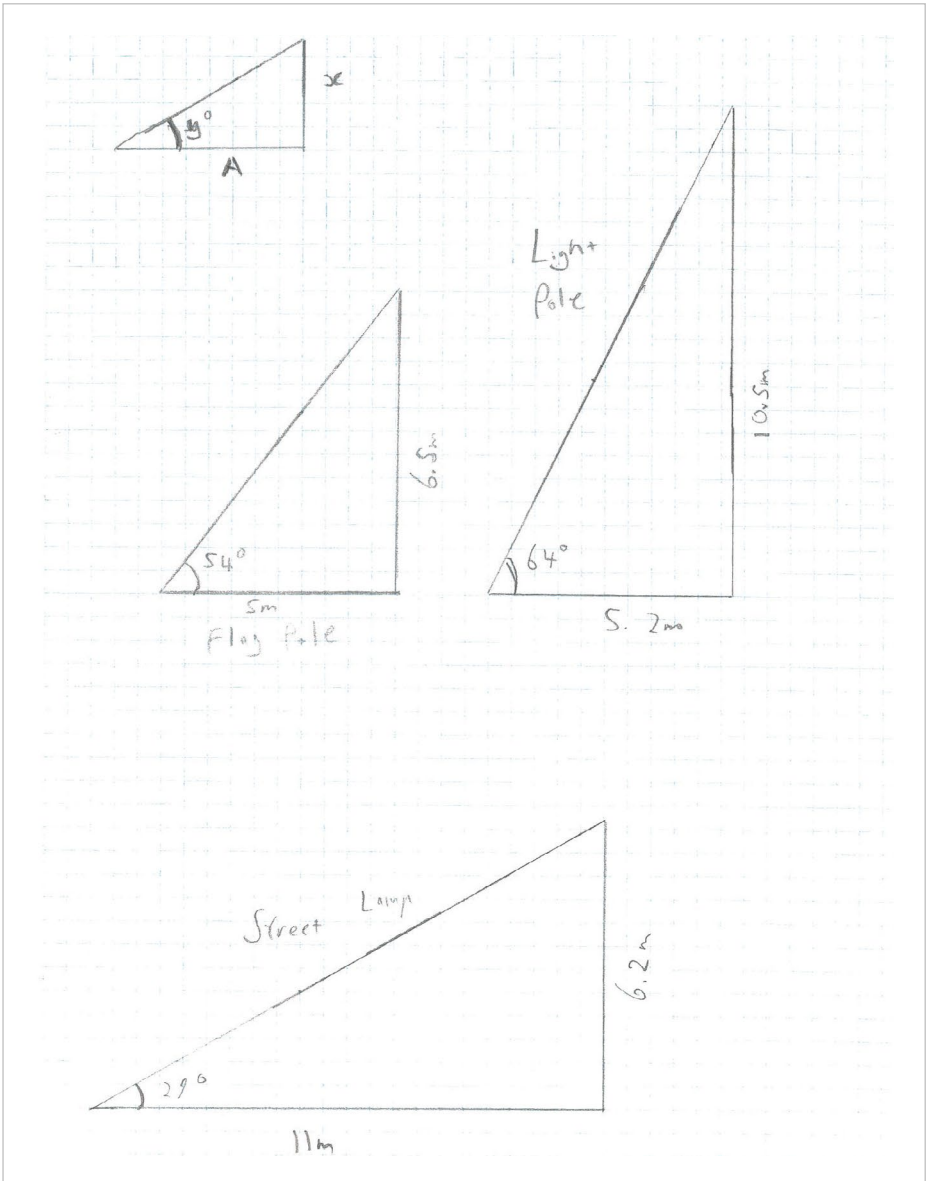
Geometry: Similar triangles



Annotations

Calculates height of four real-world objects but does not show any calculations involving ratios or scale factors in similar figures.

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Probability: Probabilities

Year 9 Mathematics achievement standard

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Summary of task

Students had been collecting data from experiments and using their data to investigate probabilities. Students were given the objects to complete this task in a 15-minute time period.

Probability: Probabilities

Probabilities

You have a bag of 10 balls containing 4 red ball and 6 green balls. You also have a coin which you can toss to get a head or a tail. You are going to pick a ball from your bag and then toss a coin 20 times.

Record your results in the table below.

	Colour of ball R or G	Toss of the coin H or T	
1	R	H	1
2	G	H	
3	R	T	
4	G	T	
5	G	H	
6	G	T	
7	R	T	
8	R	T	
9	G	H	
10	R	H	2
11	G	H	
12	R	T	
13	R	T	
14	G	H	
15	R	T	
16	G	H	
17	G	T	
18	R	H	3
19	G	T	
20	G	H	

List below all the possible results from choosing a ball and tossing a coin

Red + Heads

Green + Heads

1. How many times would you expect to choose a green ball and toss a tail? 1/4
2. How many times would you expect to choose a red ball and toss a head?
3. Did your results differ from what you would expect? yes

Can you explain why there might be a difference? You can never tell - it's a gamble each time

Annotations

Recognises two possible outcomes of the experiment.

Makes a statement without any mathematical reasoning.

Number: Index laws

Year 9 Mathematics achievement standard

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Summary of task

Students had been revising index laws and applying them to numbers. They had investigated the use of scientific notation in various contexts. Students were asked to complete this quick quiz in a 15-minute time period.

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Number: Index laws

Index laws and Numbers

1. Answer the following questions

Question	Answer	Question	Answer
1. $2^3 \times 2^5 =$	2^8	2. $2^6 \div 2^4 =$	2^2
3. $4^2 \times 4^1 =$	4^3	4. $7^7 \div 7^5 =$	7^2
5. $6^1 \times 6^1 =$	6^2	6. $8^4 \div 8^4 =$	8^1
7. $(2^3)^2 =$	2^5	8. $10^0 =$	0
9. $2(3^0)^2 =$	0	10. $2^3 \div 2^5 =$	2^2
11. $25^{\frac{1}{2}} =$	$\frac{1}{25}$	12. $16^{\frac{1}{2}} \times 16^{\frac{1}{2}} =$	$\frac{1}{16}$ 16

2. Express the following numbers in scientific notation:

Question	Answer	Question	Answer
1. 100	1×10^2	2. 5010	5.01×10
3. 210000	21×10^4	4. 7567	7.567×10
5. 0.0025	0.25×10^{-2}	6. 0.00000012	0.12×10^{-6}
7. 32654	3.2654×10	8. 0.000003652	0.3652×10^{-5}
9. 10001000	$1000.1.0 \times 10^3$	10. 0.001000356	0.1000356×10

3. Why is it necessary to write numbers in scientific notation? Can you give examples?

It helps in science.

Annotations

Recognises and applies some index laws correctly.

Demonstrates limited understanding of scientific notation.

Makes a statement without mathematical reasoning.

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Algebra: Linear relationships

Year 9 Mathematics achievement standard

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Summary of task

Students had completed a unit of work on linear relationships. They had investigated the gradient and midpoint of the interval joining two points and the distance between those two points on the Cartesian plane. Students were given a series of questions on the topic and completed the task as a test in class.

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Algebra: Linear relationships

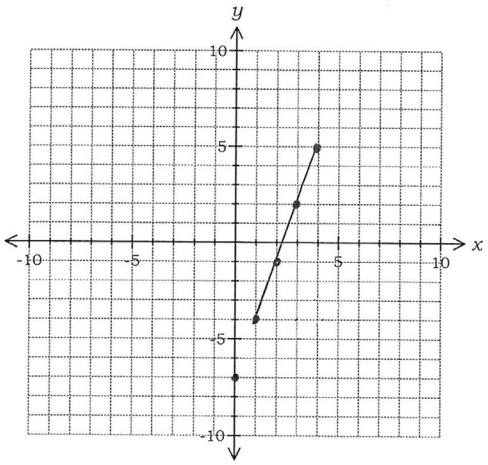
Number and Algebra	

- Answer all questions neatly in the spaces provided.
- **Show all working** where appropriate.
- If necessary, round all answers to **2 decimal places** unless stated otherwise.
- **Calculator allowed.**

Question 1

Plot the line represented by the points in the following table on the axes provided below.

x	0	1	2	3	4
y	-7	-4	-1	2	5



Annotations

Plots points and joins four of them.

Mathematics

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Below satisfactory

Algebra: Linear relationships

Question 2

(a) The tables below represent linear relationships. How can you tell?

(i)

x	0	1	2	3	4
y	4	9	14	19	24

(ii)

x	1	2	3	4	5
y	10	7	4	1	-2

because the tables are showing where the x and y axis are.

(b) Determine the rule between x and y for the tables in (a).

(i) difference in y / difference in x

$= \frac{5}{1}$ ∴ gradient = 5

$y = mx + c$

(1, 9) $1 = 5 + 9 = c$

$1 = 14$

$c = 14$

(ii) difference in y / difference in x

$= \frac{3}{1}$ ∴ gradient = 3

$y = mx + c$

(2, 7)

$2 = 7 + 3$

$= 2 = 10$

$c = 10$

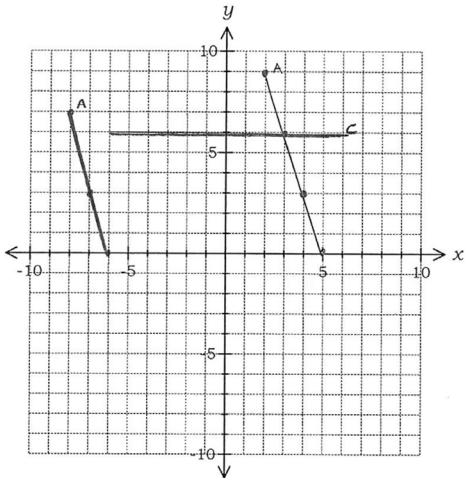
Question 3

On the axes below, plot the following lines, labelling each one.

A: a line that has a gradient of 3 and a y-intercept at (0, 5).

B: the line $y = \frac{1}{4}x - 6$.

C: the line $x = 6$.



Annotations

Makes statement without mathematical reasoning.

Demonstrates understanding of gradient but limited understanding of the gradient intercept form of a straight line.

Mathematics

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Below satisfactory

Algebra: Linear relationships

Question 4

Determine the equations of the following lines. Show all working.

(a) The line with a gradient of $\frac{1}{2}$ with a y-intercept of 6.

$y = \frac{1}{2}x + 6$

(b) The line that has a gradient of 4 and passes through the point (2, 3).

$y = 4x + \frac{2}{3}$

(c) The line that passes through the points (2, 5) and (-3, -10).

$\frac{-10 - 5}{-3 - 2} = \frac{15}{5}$

$= 3$

$y = 3x + c$

Annotations

Demonstrates limited understanding of the equation of a straight line.

Uses the formula to find gradient.

Measurement: Volume of a prism

Year 9 Mathematics achievement standard

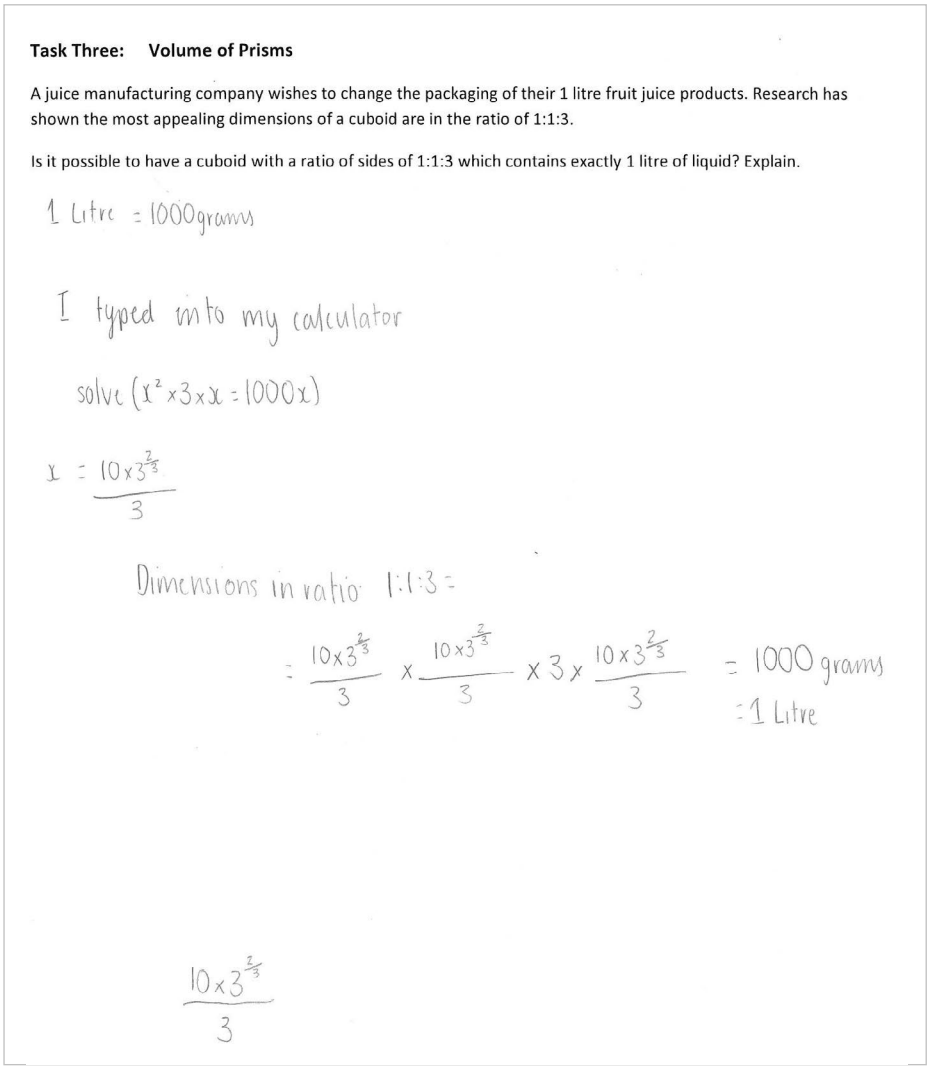
The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students solve problems involving simple interest. They interpret ratio and scale factors in similar figures. Students explain similarity of triangles. They recognise the connections between similarity and the trigonometric ratios. Students compare techniques for collecting data in primary and secondary sources. They make sense of the position of the mean and median in skewed, symmetric and bi-modal displays to describe and interpret data.*
>
> *Students apply the index laws to numbers and express numbers in scientific notation. They expand binomial expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment. They sketch linear and non-linear relations. Students calculate areas of shapes and the volume and surface area of right prisms and cylinders. They use Pythagoras' Theorem and trigonometry to find unknown sides of right-angled triangles. Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes. They construct histograms and back-to-back stem-and-leaf plots.*

Summary of task

Students had completed a unit of work on volume and surface area. The activity involved a real-world problem in which they were given the volume of a cuboid and asked to determine appropriate dimensions given a particular relationship between them. Students were given 10 minutes to complete the task in class.

Measurement: Volume of a prism



Task Three: Volume of Prisms

A juice manufacturing company wishes to change the packaging of their 1 litre fruit juice products. Research has shown the most appealing dimensions of a cuboid are in the ratio of 1:1:3.

Is it possible to have a cuboid with a ratio of sides of 1:1:3 which contains exactly 1 litre of liquid? Explain.

1 Litre = 1000grams

I typed into my calculator

solve $(x^2 \times 3 \times x = 1000x)$

$x = \frac{10 \times 3^{\frac{2}{3}}}{3}$

Dimensions in ratio 1:1:3 =

$= \frac{10 \times 3^{\frac{2}{3}}}{3} \times \frac{10 \times 3^{\frac{2}{3}}}{3} \times 3 \times \frac{10 \times 3^{\frac{2}{3}}}{3}$ = 1000 grams
= 1 Litre

$\frac{10 \times 3^{\frac{2}{3}}}{3}$

Annotations

Equates litres with grams instead of millilitres.

Attempts to form an equation in order to solve the problem but with an error, and is unable to demonstrate the algebraic manipulation required to obtain an answer.

States an exact value for the smaller length.

Shows the exact dimensions of a cuboid but is unable to express the reasoning required to obtain an answer to the question posed.

Mathematics

Year 9
Below satisfactory

Measurement: Surface area and volume

Year 9 Mathematics achievement standard

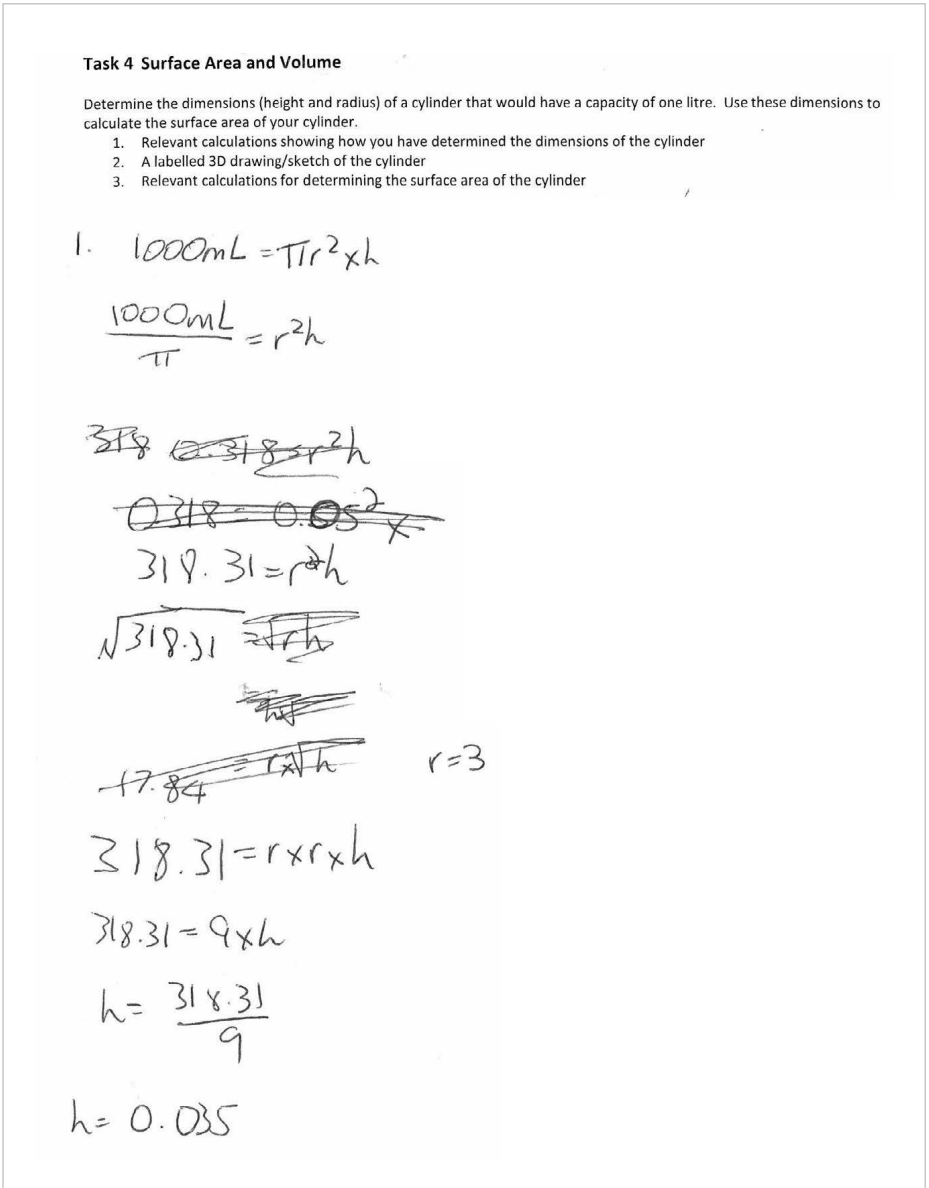
The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students solve problems involving simple interest. They interpret ratio and scale factors in similar figures. Students explain similarity of triangles. They recognise the connections between similarity and the trigonometric ratios. Students compare techniques for collecting data in primary and secondary sources. They make sense of the position of the mean and median in skewed, symmetric and bi-modal displays to describe and interpret data.*
>
> *Students apply the index laws to numbers and express numbers in scientific notation. They expand binomial expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment. They sketch linear and non-linear relations. Students calculate areas of shapes and the volume and surface area of right prisms and cylinders. They use Pythagoras' Theorem and trigonometry to find unknown sides of right-angled triangles. Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes. They construct histograms and back-to-back stem-and-leaf plots.*

Summary of task

Students had completed a unit of work on volume and surface area. This activity involved determining the dimensions of a cylinder with a capacity of one litre and then using the dimensions to calculate the surface of the cylinder. Students were given 10 minutes to complete the task in class.

Measurement: Surface area and volume



Task 4 Surface Area and Volume

Determine the dimensions (height and radius) of a cylinder that would have a capacity of one litre. Use these dimensions to calculate the surface area of your cylinder.

1. Relevant calculations showing how you have determined the dimensions of the cylinder
2. A labelled 3D drawing/sketch of the cylinder
3. Relevant calculations for determining the surface area of the cylinder

1. $1000mL = \pi r^2 \times h$

$\frac{1000mL}{\pi} = r^2h$

~~$318 = 0.318 \times r^2h$~~

~~$0318 = 0.05^2 \times$~~

$319.31 = r^2h$

$\sqrt{318.31} = \sqrt{rh}$

~~$17.84 = r \times \sqrt{h}$~~ $r = 3$

$318.31 = r \times r \times h$

$318.31 = 9 \times h$

$h = \frac{318.31}{9}$

$h = 0.035$

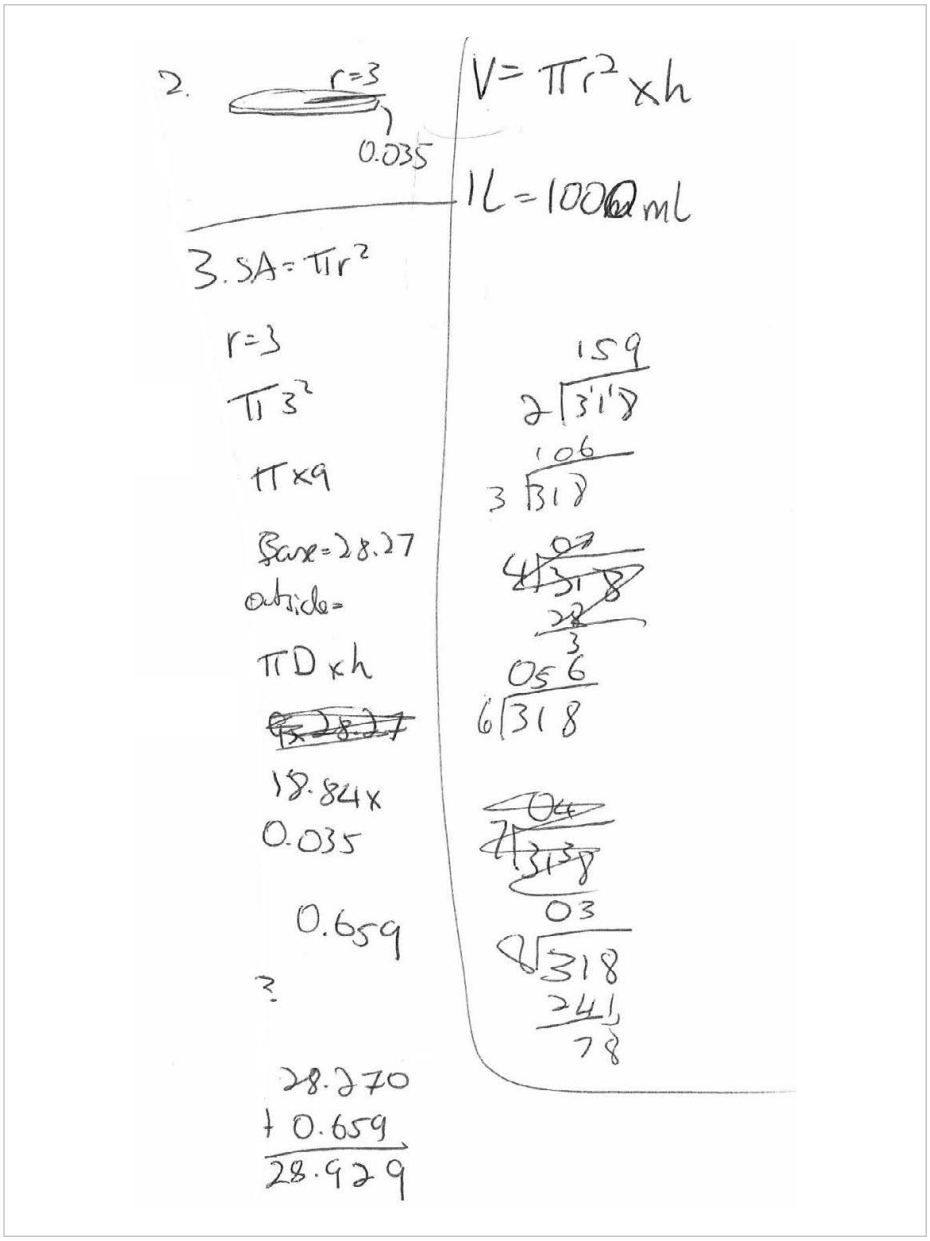
Annotations

Uses units of capacity instead of units of volume.

Sets up an appropriate equation that can be solved to find the height of the cylinder but works with approximate values instead of exact values.

Demonstrates some understanding of the equation solving process but obtains an incorrect value for the height of the cylinder.

Measurement: Surface area and volume



Annotations

Draws a cylinder and labels it with the dimensions obtained in the previous part of the task.

Finds the area of one circular surface of the cylinder.

Finds the area of the curved surface of the cylinder using the dimensions obtained in the previous part of the task.

Attempts to calculate the total surface area of the cylinder but includes only one circular surface and has reduced accuracy due to rounding values prior to the final calculation.

Statistics: Data displays

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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> *Students apply the index laws to numbers and express numbers in scientific notation. They expand binomial expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment. They sketch linear and non-linear relations. Students calculate areas of shapes and the volume and surface area of right prisms and cylinders. They use Pythagoras' Theorem and trigonometry to find unknown sides of right-angled triangles. Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes. They construct histograms and back-to-back stem-and-leaf plots.*

Summary of task

Students had completed a unit of work on displaying data over a two-week period. In this activity students were asked to represent the given data in a back-to-back stem-and-leaf plot and frequency histograms. The activity was given as a class test to be completed in a lesson.

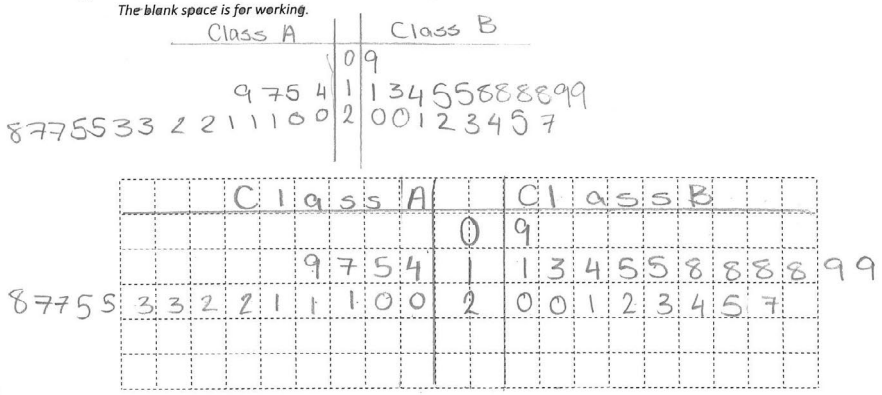
Statistics: Data displays

1 The data sets below show the marks scored by two classes in a class test (out of 30).

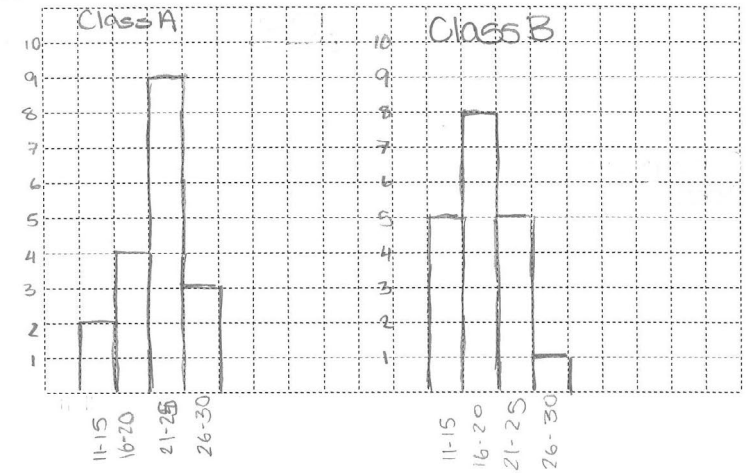
Class A 25 21 29 22 25 23 17 21 19 22 28 15 20
27 23 20 21 14 27

Class B 22 19 18 26 15 18 20 25 18 19 24 23 27
11 18 14 9 20 15 21 13

(i) Draw an **ordered** back-to-back stem-and-leaf plot to show the two classes' results.
The blank space is for working.



(ii) Draw a histogram for each class, using the groups 11-15, 16-20, etc. *Be careful to ensure they both fit.*



Annotations

Constructs the stem but does not consider splitting the stem into class intervals.

Constructs an ordered back-to-back stem-and-leaf plot showing most data values from smallest to largest on each side of the stem.

Constructs frequency histograms to represent the data but with some errors, including a few incorrect frequency values.

Labels values on the axes but does not draw the axes or name what they represent.

Measurement and geometry: Trigonometry and similarity in right-angled triangles

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

> *By the end of Year 9, students solve problems involving simple interest. They interpret ratio and scale factors in similar figures. Students explain similarity of triangles. They recognise the connections between similarity and the trigonometric ratios. Students compare techniques for collecting data in primary and secondary sources. They make sense of the position of the mean and median in skewed, symmetric and bi-modal displays to describe and interpret data.*
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Summary of task

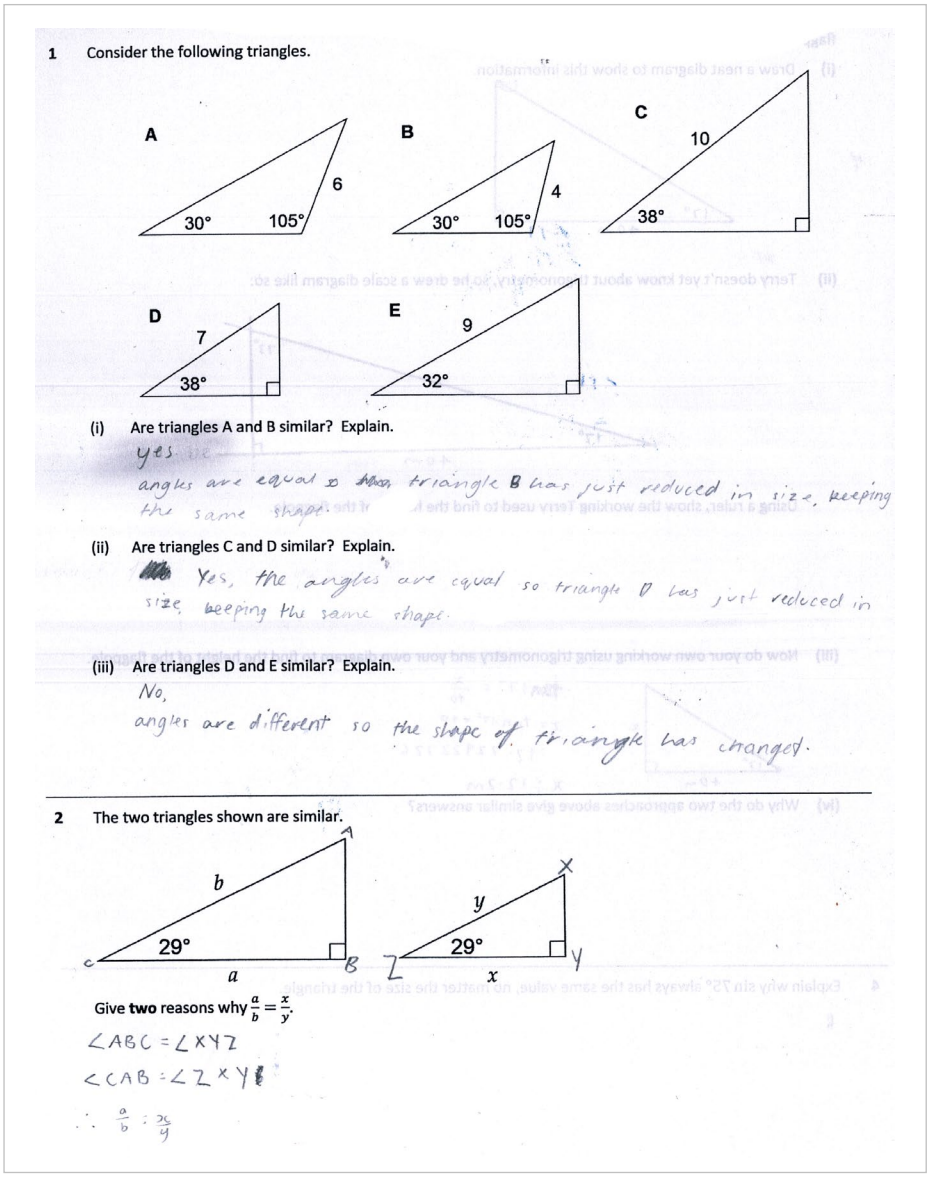
Students had completed a unit of work on trigonometry, including links to the topic of similarity that was studied earlier. In this activity, students were asked to apply their knowledge of similarity and trigonometry and apply the links between the two. The activity was given as a class test in 20 minutes.

Mathematics

Year 9

Below satisfactory

Measurement and geometry: Trigonometry and similarity in right-angled triangles



1 Consider the following triangles.

A: 30°, 105°, 6

B: 30°, 105°, 4

C: 10, 38°

D: 7, 38°

E: 9, 32°

(i) Are triangles A and B similar? Explain.

yes.
angles are equal so triangle B has just reduced in size, keeping the same shape.

(ii) Are triangles C and D similar? Explain.

Yes, the angles are equal so triangle D has just reduced in size keeping the same shape.

(iii) Are triangles D and E similar? Explain.

No,
angles are different so the shape of triangle has changed.

2 The two triangles shown are similar.

Give **two** reasons why $\frac{a}{b} = \frac{x}{y}$.

∠ABC = ∠XYZ

∠CAB = ∠ZXY

$\therefore \frac{a}{b} = \frac{x}{y}$

Annotations

Understands the concept of similarity and is able to explain why triangles are or are not similar.

Provides some reasons why the triangles are similar but does not explain how this leads to equivalent ratios.

Mathematics

Year 9

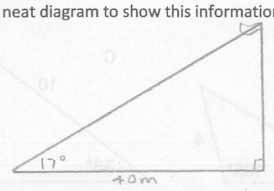
Below satisfactory

Measurement and geometry: Trigonometry and similarity in right-angled triangles

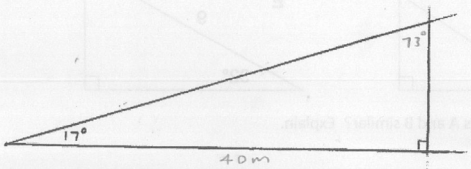
3 Terry wanted to find the height of his school's flagpole.

Having walked 40m from its base (on level ground), he measured the angle from the ground to the top of the flagpole to be 17°.

(i) Draw a neat diagram to show this information.

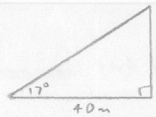


(ii) Terry doesn't yet know about trigonometry, so he drew a scale diagram like so:



Using a ruler, show the working Terry used to find the height of the flagpole.

(iii) Now do your own working using trigonometry and your own diagram to find the height of the flagpole.



$\tan 17° = \frac{x}{40}$

$x = \tan 17° \times 40$

$x = 12.27922726$

$x \doteq 12.2\text{m}$

(iv) Why do the two approaches above give similar answers?

4 Explain why sin 75° always has the same value, no matter the size of the triangle.

Annotations

Represents mathematical information given in words in diagrammatic form.

Unable to use scale drawings to determine an unknown length.

Uses the correct trigonometric ratio to set up an equation and uses a familiar procedure to obtain the correct answer.

Statistics: Academy Awards

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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Summary of task

Students had completed a unit of work on statistical displays and analysis. They were given some statistics relating to the age and gender of Academy Award winners and asked to respond to a set of questions under test conditions during a lesson.

Statistics: Academy Awards

1. Academy Awards, Age and Gender

Each year, we hear of the winners of the Academy Awards (the "Oscars") in the United States. The back-to-back stem and leaf plot below shows the ages of the Best Actors (male and female) for each year up to 1997.

Actors (male)		Actors (female)
	2	1244444
	·	56666667778889999
443322110	3	000011233334444444
9988888887775555	·	5556778889
443333222111110000	4	01111122
999888776655	·	5589
432211	5	0
6665	·	
2100	6	0112
	·	
	7	4
6	·	
	8	0

3 | 2 means 32 years

1. Use these data to find the median age of male winners and median age of female winners. Please write these below:

male: 4 female: 4 working on the back of page 2.

2. Write approximately 100 words about some things you've noticed from the data, and some possible reasons for what you've observed. (Please use the terms "median", "range", and "outlier" in your discussion if possible.)

From this data (back-back stem and leaf plot) I have noticed that the "median" ~~amount~~ age of males winners is 4 ~~th~~ and the median age of female winners is also 4. There is a ~~wide~~ "range" ~~of numbers in~~ this stem and leaf plot aswell as the "outlier." the median measures the middle number, the range measures the average of all of the numbers. and the outlier which outlies itself.

Annotations

Attempts to interpret the stem-and-leaf plot given to find the median of either data set.

Demonstrates some sense of statistical terms.

Mathematics

Year 9
Below satisfactory

Geometry: Similarity

Year 9 Mathematics achievement standard

The parts of the achievement standard targeted in the assessment task are highlighted.

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Summary of task

Students had completed a unit of work on similarity. This task consisted of a set of formal questions for written response and was completed as a test in class.

Mathematics

Year 9

Below satisfactory

Geometry: Similarity

1.

a) A triangle with an area of 40cm² is dilated by a scale factor of 1.25. What will be the area of the image?

40 ÷ 1.25 = 32

∴ the area of the image will be 32cm²

b) **After** a dilation by a scale factor of 2.5, a rectangle has an area of 100cm². What was the area of the **original** rectangle?

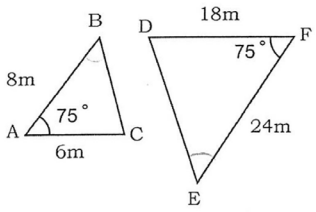
100 ÷ 2.5 = 40

the area of the original rectangle was 40cm².

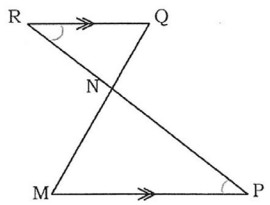
2.

Complete the similarity statements for the triangles below, putting letters in the correct order and stating the reason (AAA,RHS,SAS or SSS) for similarity.

a)



b)



ΔABC ~ DEF (AAA)

ΔMPN ~ ΔQRN (AAA)

Annotations

Accounts for only one dimension when solving a problem involving the dilation of an area by a scale factor.

Recognises one similarity test and does not always write vertices in corresponding order when describing triangles.

Mathematics

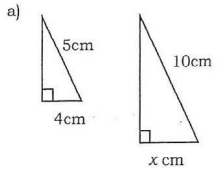
Year 9
Below satisfactory

Geometry: Similarity

3.

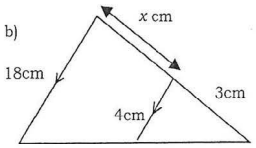
In each diagram below, the two triangles are similar. Determine the value of x in each diagram.

a)



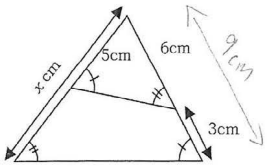
$x = 8cm$

b)



$18 \div 4 = 4.5$
$3 \times 4.5 = 13.5$
$13.5 - 3 = 10.5$
$x = 10.5cm$

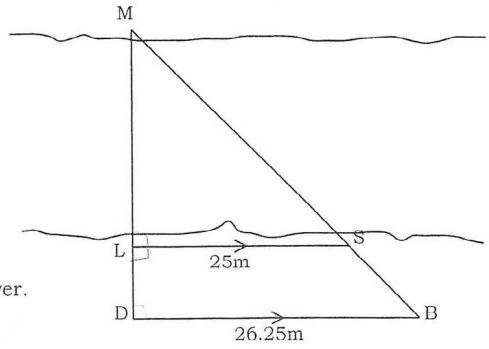
c)



$9 \div 6 = 1.5$
$5 \times 1.5 = 7.5$
$x = 7.5cm$

4.

To measure the width of a raging river, sisters Lindy and Diana Jones both position themselves on one side of the river, opposite a marker tree, M. Lindy is on the river bank at L, and Diana is 15m back from the bank at D. Both girls walk parallel to the riverbank until they reach sighter bushes (S and B)that both line up with the marker tree. The distances they walk are shown in the diagram below.



a) State why triangles MLS and MDB are similar.

AAA

b) Determine the width of the river.

$26.25 \div 25 = 1.05$

Annotations

Demonstrates some understanding of how to calculate an unknown side.

Identifies the correct similarity test to determine that the triangles are similar.

Calculates the scale factor.