

### WORK SAMPLE PORTFOLIOS

These work sample portfolios have been designed to illustrate satisfactory achievement in the relevant aspects of the achievement standard.

The December 2011 work sample portfolios are a resource to support planning and implementation of the Foundation to Year 10 Australian Curriculum in English, Mathematics, Science and History during 2012. They comprise collections of different students' work annotated to highlight evidence of student learning of different aspects of the achievement standard.

The work samples vary in terms of how much time was available to complete the task or the degree of scaffolding provided by the teacher.

There is no pre-determined number of samples required in a portfolio nor are the work samples sequenced in any particular order. These initial work sample portfolios do not constitute a complete set of work samples - they provide evidence of most (but not necessarily all) aspects of the achievement standard.

As the Australian Curriculum in English, Mathematics, Science and History is implemented by schools in 2012, the work sample portfolios will be reviewed and enhanced by drawing on classroom practice and will reflect a more systematic collection of evidence from teaching and learning programs.

### THIS PORTFOLIO – YEAR 9 MATHEMATICS

This portfolio comprises a number of work samples drawn from a range of assessment tasks, namely:

- Sample 1 Statistics assignment
- Sample 2 Interpreting graphs
- Sample 3 Simple interest
- Sample 4 Histograms and polygons
- Sample 5 Identifying the midpoint on a Cartesian plane
- Sample 6 Everyday volume and capacity problems
- Sample 7 Can do trigonometry

This portfolio of student work shows the calculation of simple interest on an item and investigates the actual cost of the item after paying the interest (WS3). The student collects data from primary and secondary sources, represents the data in various ways and critically evaluates and analyses the data to draw conclusions (WS1). The student calculates the mean, median and mode for the data (WS2), identifies the skewness and compares the data to secondary sets of data (WS4). The student calculates the volume of cylinders in authentic situations and calculates the areas of different shapes (WS6). The student calculates the midpoint of a line segment on the Cartesian plane (WS5) and uses trigonometry to find unknown sides of triangles (WS7).



The following aspects of the achievement standard are not evident in this portfolio:

- · interpret ratio and scale factors in similar figures
- explain similarity of triangles
- · recognise the connections between similarity and the trigonometric ratios
- apply the index laws to numbers and express numbers in scientific notation
- expand binomial expressions
- find the distance between two points on the Cartesian plane and the gradient of a line segment
- sketch linear and non-linear relations
- calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes.

# Work sample 1: Statistics assignment

### Relevant parts of the achievement standard

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 from 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 have learnt about collecting primary and secondary sources of data, representing data in a variety of ways and drawing valid conclusions based on their findings.

In this task students were asked to:

- collect data from their classmates for four different measures
- construct frequency distribution tables and histograms and a back to back stem-and-leaf plot
- find mean, mode, median and range for their sets of data
- identify skew
- compare collected data to secondary data
- draw conclusions based on their data.



# Work sample 1: Statistics assignment

Maths Assignment

Task 1: Take the four measurements for yourself and record them in a table like the one below. Answer to the nearest centimetre. Add the measurements of your classmates to the table.

		Task		
		One		
	Height	Arm span	Belly button	Right foot
	in cm	in cm	to toes in cm	in cm
Person 1	159	156	96	27
Person 2	165	169	98	25
Person 3	195	190	122	32
Person 4	166	166	104	24
Person 5	176	182	108	30
Person 6	175	183	109	30
Person 7	171	182	107	24.5
Person 8	170	174	107	23
Person 9	172	181	96	25
Person 10	169	175	100	26
Person 11	173	178	100	26
Person 12	159	147	95	24
Person 13	177	187	108	29
Person 14	169	166	100	27
Person 15	171	166	100	35
Person 16	172	170	106	30
Person 17	174	173	107	30
Person 18	160	157	96	21
Person 19	188	173	108	31
Person 20	155	151	101	25
Person 21	190	184	115	32
Person 22	167	159	105	24.5
Person 23	174	172	102	26

### Annotations

Collects data and records in a table.



# Work sample 1: Statistics assignment

Task 2; Analyse the data using summary statistics

1. Represent the variables of the class by finding the mean, median, mode and range for each.

	Mean	Median	Mode	Range
Height in cm	171.6	171	159	40
Arm span in cm	171.3	173	166	43
Belly button to toes in cm	103.9	104	100	27
Right foot in cm	27.3	26	30	14

#### How I worked out the mean

The mean was worked out by adding together all the digits from certain measurements, (for example the height) together and dividing it by the number of digits to get the average.

#### How I worked out the median

The median was worked out by arranging all the digits in numerical order and finding the middle number.

#### How I worked out the mode

II worked out the mode by arranging the numbers in numerical order and finding the most commonly occurring digit.

#### How I worked out the range

I worked out the range by arranging the digits in numerical order and finding the lowest number and subtracting that number from the highest digit.

### Annotations

Calculates mean, median, mode and range and explains their calculating processes.



# Work sample 1: Statistics assignment

4. Look carefully at your analysis. Which one of mean, mode or median best represents you class for the height variable? You might use more than one. Justify your response.

The data that best represents the height variable in our class is the median.

5. After summarising the data, analyse how you compare to your class.

My results are different to the class of 9.2, the data collected shows that I am below average in height, arm span, length of belly button to toes and right foot size. I am not a typical student in the class.

#### Task 3. Display your Data in a histogram.

Graphs provide a visual representation of the data that can give a quick impression of the distribution. Grouped numerical data is best represented in a histogram.

6. Construct a frequency table then draw a histogram to represent the data in the height column for your class.

Interval	Tally	Frequency
155-159		3
160-164		1
165-169		5
170-174		8
175-179		3
180-184		0
185-189		1
190-195		2





#### Annotations

Identifies the median as the best measure of height variability.

Uses data to support statement.



Year 9 Mathematics - Work sample 1

## **Mathematics**

# Work sample 1: Statistics assignment

#### 7. Is the histogram skewed, bimodal or symmetrical?

The histogram (located above) is not skewed, or bimodal or symmetrical. A skewed histogram means that more data leans towards one side.

### 8. What does the histogram tell you that the mean, mode and median don't tell you about how you compare to your class?

The histogram tells you whether or not there is an outlier amongst the data presented above, it shows the interval that has the highest and lowest number of people, in the histogram above, the interval that has the most amount of people is 170-174, the mean, median and mode do not show this data.

### 9. Repeat all the steps above for the arm span. The belly button height and the right foot length.

#### Arm span;

Interval	Tally	Frequency
147-151	11	2
152-156	1	1
157-161		2
162-166	111	3
167-171	11	2
172-176		5
177-181	11	2
182-186	1111	4
187-191		2



### Annotations

Repeats process for arm span.



# Work sample 1: Statistics assignment

#### Is the histogram skewed, bimodal or symmetrical?

The histogram that is located above is not skewed, or bimodal or symmetrical.

## What does the histogram show you that the mean, median and mode don't tell about how you compare to the class?

The histogram tells you whether certain digits are outliers or not. It shows you what intervals are the most common and which are the least. In the histogram there is no outlier and the measurements are more grouped together than for height.

#### Belly Button to Toes;

Interval	Tally	Frequency
95-99		5
100-104		7
105-109		9
110-114		0
115-119	1	1
120-124	1	1

#### Histogram



### Annotations

Repeats process for belly button to toes.



Year 9 Mathematics - Work sample 1

## **Mathematics**

# Work sample 1: Statistics assignment

#### 1. Is the histogram skewed, bimodal or symmetrical?

The histogram is skewed to the left side this is evident because the data leans towards the side on the left

2. What does the histogram tell you that the mean, mode and median don't tell about how you compare to the class?

The histogram shows that there is an outlier amongst the data, in the <u>interval</u> <u>115</u>-119 and 120-124 cm there are very few people, it shows that the measurements are not typical.

Interval	Tally	Frequency
21-23	П	2
24-26	11111111	10
27-29	111	3
30-32	111111	7
33-35		1

Histogram



### Annotations

Constructs histogram from data.



# Work sample 1: Statistics assignment

Task 4; Display Height and arm span data in a back to back stem and leaf Plot.

10. Construct a back to back stem and leaf plot for height versus arm span of the sample.

Height	Back to back stem and leaf plot	Arm span
	14	7
9,9,5	15	1,6,7,9
9,9,7,6,5,0	16	6,6,6,9
7,6,5,4,4,3,2,2,1,1,0	17	0,2,3,3,4,5,8
8	18	1,2,3,4,7
5,0	19	0

### 11. What does the stem and leaf plot tell you about the correlation between the arm span and height?

In the stem and leaf plot it is evident that both measurements of height and arm span are very similar, in most cases they are the same. Studies show that the arm span is considered a valid measurement of a person's height and it is apparent in this stem and leaf plot.

#### Task five; Comment on your results.

## 12. Prepare a written summary that describes your class. Include each of the four measures and any findings you gain from your summary statistics, histograms and stem and leaf plot. Use this to describe the typical student in your class.

In class 9.2 the average student is 171.6 centimetres tall and has an arm span of about 171.5 cm, which is almost the same as the height, this data has proven the theory that the height is similar, if not the same height as the length between the arms. The typical student has a length of 103.9 cm between the belly button and the bottom of the foot and the right foot is 27.3 cm long. This data is affected by certain outliers that change the average to a bigger or smaller number

#### 13. Are you a typical student in your class? If not how close to being typical are you?

I am not a typical person in my class. I am below average in height, arm span, the length between my belly button and feet, and my foot length. I am not close to average, the typical height of the average person i my class is 171.6 cm and my height is 159 cm which means I am 12.6 cm below average. My arm span is 156 cm whereas the typical arm span is 171.3 cm which is 17.3 cm below. My measured length between my belly button and my toes is 96 cm and the average length for a typical person is 103.9 cm.

### Annotations

Constructs back to back stem-and-leaf plot.

Draws conclusions from stem-and-leaf plot.

Compares personal measurements to measurements from the class.

Uses means for each measurement to explain why they are not typical.



# Work sample 1: Statistics assignment

#### Extension

#### How do you compare to Australian students?

This is the final part of your investigation in which you conduct a similar analysis on your sample of Australian students. This will enable you to describe Australian students from the Australian census at school project and see how you and your class compare.

14. Go to <u>http://www.abs.gov/censesatschool</u> click on the random sampler link and get a sample of 100 Australian students of your year. You could take a sample for a particular state or territory if you prefer

	Mean	Median	Mode	Range
Height in cm	164.7	168	160	26
Arm span	160.0	166	167	21
Belly button to toes	101.38	102	100	100
Right foot in cm	24.96	25	23	16

#### Typical student compared to me

	Ме	Typical student in 9.2	Typical Australian student
Height in cm	159	171.6	164.7
Arm span	156	171.3	160.6
Belly button to toes	96	103.9	101.38
Right foot in cm	27	27.3	24.96

Most of my measurements are below the average for Australian students in year nine; my height is 159 cm whereas the average height for an Australian student is 164.7

### Annotations

Records information collected from a secondary source in a table.

Records personal measurements, class mean measurements and Australian mean measurements on a table.

*Compares own height to mean height for Australian students in Year 9.* 

#### Acknowledgment

ACARA acknowledges the contribution of trial school teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

# Work sample 2: Interpreting graphs

### Relevant parts of the achievement standard

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 have been studying data found in newspapers and have been evaluating claims made in the media.

Students were asked to complete a worksheet in class based on the information supplied in the newspaper article.



Year 9 Mathematics - Work sample 2

## **Mathematics**

# Work sample 2: Interpreting graphs

ABS Education Services Misleading Statistics 1A Student Worksheet

Herald Sun, Monday, February 15, 2010

## Violence blamed on loss of male teachers Boys lack role models

A DECLINE in the number of male teachers is being blamed for rising youth violence.

Just 28 per cent of the state schoolteachers are men, down from 32 per cent 10 years ago.

Youth crime has soared in that time. Sex attacks, robberies. Assaults and weapon offences have risen significantly, and psychologists and family groups told the *Herald Sun* the loss of male role models was and important factor.

....

There are almost 1900 more secondary teachers than 10 years ago, but there are 350 fewer men among them.

Male teacher numbers in primary schools have remained steady but they account for less than 25 per cent of the total. Adolescent

psychologist Michael Carr-Gregg said the lack of male teachers was a major problem.

"We know males give something different to the developing boy than what female teachers give," he said.

"To some extent we have lost that male narrative and left it to Hollywood to teach boys about masculinity."

Assaults by 10 - 14year-olds almost doubled in the past decade, to 1162 in 2008 - 09. Among 15-19-year -olds, assaults jumped by more than 70 percent to 6500. Property damage by 15-19-year-oleds jumped almost 5-fold, from 1217 to 5681. Among 10-14-yearolds such offences rose by more than 60 per cent to 1962.

... ...

Ms Pike's spokesman disputed the presence of a link between youth crime and male teacher numbers. "Promoting respectful behaviour through our "Respect in Schools'

program is designed to address these issues," he said.

... ...

Australian family Association spokesman John Morrissey, a parttime teacher, said solid, reliable male authority figures were vital to the development of boys and girls, particularly in no-father households.

He said a quota system was needed to boost male teachers.



FIGURE 1 Male Assault and Number of Male School Teachers



# Work sample 2: Interpreting graphs





# Work sample 2: Interpreting graphs



Use the grid overleaf to graph the following information of the Number of Victims of Blackmall and Extortion. Graph how the information may look if you were:

a) The Minister for Public Safety
b) Citizens for a Greater Police Presence.

Year	Blackmail/extortion
1999	254
2000	255
2001	358
2002	355
2003	386
2004	372
2005	393
2006	444
2007	424
2008	418



# Work sample 2: Interpreting graphs



### Annotations

Uses vertical scales appropriately to exaggerate or minimise change of levels of data.

Demonstrates a clear understanding of how scale can be misused to distort data.

#### Acknowledgment

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# Work sample 3: **Simple interest**

### Relevant parts of the achievement standard

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 were asked to answer the following question as part of a homework task on simple interest:

Joanna has borrowed \$5000 from Westpac to help pay for an entertainment system. The \$5000 was obtained at a per annum interest rate of 5% and a period of 36 months. How much has the system cost Joanna?



# Work sample 3: Simple interest

Simple interest paid = (principal \* interest rate \* term length) / 100

Principal = \$5000

Interest rate per year = 5%

Term length = 36 months or 36/12 = 3 years

Simple Interest = 5000 x 5 x 3/100 = \$750

Joanna will need to pay \$750 + \$5000 = \$5700 for the system.

### Annotations

Uses I = PRT/100 to accurately calculate simple interest to be paid on a loan and recognises that both interest and principal are included in total costs.

Acknowledgment

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# Work sample 4: Histograms and polygons

### Relevant parts of the achievement standard

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 have constructed frequency tables, frequency histograms, cumulative frequency histograms and polygons. They have discussed the meaning of skewness and how to recognise a skewed distribution. Students have also discussed the relationship between a skewed distribution and the mean and median.

Students were asked to construct a cumulative frequency histogram and polygon (ogive) and use the polygon to find the median of the distribution. They constructed a frequency histogram and drew conclusions regarding the shape of the distribution, connecting the mean and median to the skewness of the distribution.



# Work sample 4: Histograms and polygons



3. Use your diagram to find the median. Median = 4

Annotations

Demonstrates a thorough knowledge of histograms and polygons.

Uses mathematical language appropriately.

Estimates the median from the graph.



# Work sample 4: Histograms and polygons



5. Describe the shape of this distribution, and make any conclusions you can about the mean and me

As the results one negatively skewed the median is greak. than the mean. The tail of the lowest scores brigs down the value of the means

### Annotations

Draws the frequency histogram from the table.

Justifies the shape of the histogram.

Acknowledgment

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# Work sample 5: **Identifying the midpoint on a Cartesian plane**

### Relevant parts of the achievement standard

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 spent some time practicing calculations of gradient, midpoint and distances between points on a Cartesian plane. They were assessed by the task below.

'If the midpoint of an interval is (1, 3), what might the endpoints of the interval be?'

Students gave reasons for their solution.



# Work sample 5: **Identifying the midpoint on a Cartesian plane**



**Annotations** 

Identifies end points of two line segments with the given midpoint.

Uses appropriate strategies but only horizontal and vertical solutions are found.

*Includes appropriate mathematical language, notation and diagrams.* 

Acknowledgment

ACARA acknowledges the contribution of the NSW Board of Studies for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.



## Work sample 5: **Everyday volume and capacity problems**

### Relevant parts of the achievement standard

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

An A4 piece of paper can be rolled to form a cylinder in two different ways, resulting in either a 'tall thin cylinder' or a 'short fat cylinder'. Students were asked to:

- draw a sketch of the two cylinders
- determine which cylinder would hold the most
- explain their method, showing measurements and calculations used.



Year 9 Mathematics - Work sample 6

## **Mathematics**

# Work sample 6: **Everyday volume and capacity problems**

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1 think & Fat	that the short Skinny

### Annotations

Uses mathematical reasoning to identify the radius of both cylinders and from this accurately calculates the volume of both cylinders.



**Annotations** 

## **Mathematics**

## Work sample 6: **Everyday volume and capacity problems**



c) My method is I would first find the radius and the height of the two aylinders. I would do this by measuring this actual paper I am writing on to find the radius and the height. The I would use the formula for the volume of a cylinder (which is V=JCr<sup>2</sup> h) to find which of the two cillinders above could fit move inside.

Uses mathematical reasoning to identify the radius of both cylinders and from this accurately calculates the volume of both cylinders.

#### Acknowledgement

ACARA acknowledges the contribution of trial school teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.



# Work sample 7: Can do trigonometry

### Relevant parts of the achievement standard

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 were asked to complete questions in class to demonstrate their understanding of trigonometry.



## Work sample 7: Can do trigonometry



### Annotations

Demonstrates understanding of trigonometric ratios in right angled triangles by illustrating some with diagrams and by labelling sides clearly with 'hypotenuse', 'opposite' and adjacent.

Uses tangent ratio to find unknown sides by writing and solving their own problem.

Illustrates angles of elevation and depression correctly.

#### Acknowledgment

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