



MATHEMATICS STANDARD 2

HSC Exam* Questions by Topic

2015 - 2019

v2020

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from NESAs

Year 11 Course

Algebra

A1: Formulae and equations

A2: Linear relationships

Measurement

M1.1: Practicalities of measuring

M1.2: Perimeter, area and volume

M1.3: Units of energy and mass

[M2: Working with time](#)

Financial Mathematics

F1.1: Interest and depreciation

F1.2: Earning & managing money

F1.3: Budgeting and household expenses

Statistics Analysis

S1.1: Classifying and representing data

[S1.2: Summary Statistics](#)

S2: Relative frequency & probability

Year 12 Course

Algebra

A4.1: Simultaneous Linear Equations

A4.2: Non-linear relationships

Measurement

M6: Non-right-angled trigonometry

[M7: Rates and ratio](#)

Financial Mathematics

F4.1: Investments

F4.2: Depreciation and loans

F5: Annuities

Statistical Analysis

S4: Bivariate data analysis

S5: The normal distribution

Networks

N2.1: Network concepts

[N2.2: Shortest paths](#)

N3: Critical path analysis

[Mathematics Standard 2 Reference Sheet \(2020 HSC\)](#)

Questions by Topic from ...

- 2019 Mathematics Standard 2 HSC
- Mathematics Standard 2 Sample exam questions [SQ] (2019)
- Selected NESAs Topic Guidance questions [TG] (2018)
- 2015 – 2018 Mathematics General 2 HSCs (eg 17 MG)

HSC Examination Papers Mathematics Standard 2 (2019) and Mathematics General 2 (including Maths General from 2015-2018); Mathematics and Mathematics Extension 1 (2015-2019), and Mathematics Standard 1 (2019) © NSW Education Standards Authority for and on behalf of the Crown in right of the state of New South Wales.

Year 11: Measurement

M2: Working with time

[Back](#)

Syllabus: updated November 2019. Latest version @

<https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-standard-2017>

Students:

- indicate positions on the Earth's surface ◇
 - locate points on Earth's surface using latitude, longitude or position coordinates with a globe, an atlas and digital technologies, eg a smartphone or GPS device 📱
- calculate times and time differences around the world AAM ◇
 - review using units of time, converting between 12-hour and 24-hour clocks and calculating time intervals
 - understand and use the link between longitude and time to find time differences [Yr 12 2020: not in syllabus Projectmaths]
 - solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving (ACMEM163) ⚙️🌐🕒
 - solve problems involving Coordinated Universal Time (UTC), and the International Date Line (IDL)
 - find time differences between two places on Earth using recognised international time zones (ACMEM165) 🌐🕒
 - review how to interpret timetables, eg bus, train and ferry timetables, and use them to solve problems 🕒🕒
 - solve practical problems, eg travelling east and west, incorporating time zones, or internet and phone usage across time zones, or the timing of events broadcast live from states of countries between different time zones ⚙️📱🌐🕒

[Reference Sheet](#)

- 19 MS2** **5** The Coordinated Universal Time (UTC) of Auckland is +12 hours and the UTC of Chicago is -5 hours. **1** [Solution](#)
- When the time in Chicago is 2 pm, Thursday, what is the time in Auckland?
- A. 9 pm, Wednesday B. 7 am, Thursday C. 9 pm, Thursday D. 7 am, Friday
- NESA 2019 Mathematics Standard 2 HSC Examination

- SQ MS 2** **ME 5** **Band 2-3** Part of a train timetable is shown. **1** [Solution](#)
- Kris arrives at Amesham station at 1.45 pm and needs to get to Frampton as quickly as possible. Assuming all trains run to schedule, what is the EARLIEST time that Kris can arrive at Frampton station?
- A. 2.29 pm
B. 2.38 pm
C. 2.47 pm
D. 2.55 pm
- | | | | | |
|-----------|-------|-------|-------|-------|
| Amesham | 13.37 | 13.47 | ... | 13.55 |
| Bickford | 13.43 | ... | 14.00 | 14.02 |
| Clipsbury | ... | 14.02 | ... | 14.11 |
| Doppleton | 14.05 | 14.12 | 14.20 | 14.24 |
| Evesbury | 14.17 | 14.29 | ... | 14.43 |
| Frampton | 14.38 | ... | 14.47 | 14.55 |

NESA Mathematics Standard 2 Sample examination materials

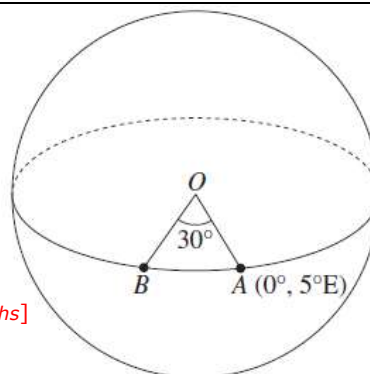
- SQ MS 2** **ME 18** **Band 2-4** Karin is in Athens, which is two hours ahead of Coordinated Universal Time (UTC). [Solution](#)
- Marco is in New York, which is five hours behind UTC.
- (a) Karin is going to ring Marco at 10 pm on Tuesday, Athens time. **1**
- What day and time will it be in New York when she rings?
- (b) Marco is going to fly from New York to Athens. His flight will leave on **2**
- Wednesday at 9 am, New York time, and will take 11 hours.
- What day and time will it be in Athens when he arrives?

NESA Mathematics Standard 2 Sample examination materials

18 MG	29a	The time in Brisbane is $4\frac{1}{2}$ hours ahead of the time in New Delhi. John flew from New Delhi to Brisbane via Singapore. His plane left New Delhi at 11:30 am (New Delhi time), stopped for 3 hours in Singapore, and arrived in Brisbane at 9:00 am the following day (Brisbane time). What was the plane's total flying time?	3	Solution
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NESA 2018 Mathematics General 2 HSC Examination

17 MG	27d	Island A and island B are both on the equator. Island B is west of island A. The longitude of island A is 5°E and the angle at the centre of the earth (O), between A and B, is 30° . (i) What is the longitude of island B? (ii) What time is it on island B when it is 10 am on island A? <i>[Not in 2020 HSC, examined in 2021 HSC Projectmaths]</i> (iii) <i>Projectmaths: not in Maths Stand 2</i>	1	Solution
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Not to scale

NESA 2017 Mathematics General 2 HSC Examination

16 MG	27e	Melbourne is located at $(38^\circ\text{S}, 145^\circ\text{E})$ and Dubai is located at $(24^\circ\text{N}, 55^\circ\text{E})$. (i) Calculate the difference in longitude between Melbourne and Dubai. (ii) Show that the time difference between Melbourne and Dubai is 6 hours. <i>[Not in 2020 HSC, examined in 2021 HSC Projectmaths]</i> (iii) A plane leaves Melbourne on Friday at 11:30 pm. The flight time to Dubai is 15 hours. What will be the time and the day in Dubai when the plane is due to land?	1 1 2	Solution
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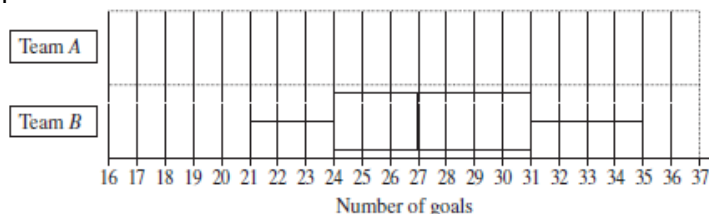
NESA 2016 Mathematics General 2 HSC Examination

15 MG	14	Stockholm is located at $59^\circ\text{N } 18^\circ\text{E}$ and Darwin is located at $13^\circ\text{S } 131^\circ\text{E}$. What is the time difference between Stockholm and Darwin? (Ignore time zones and daylight savings.) (A) 184 minutes (B) 288 minutes (C) 452 minutes (D) 596 minutes <i>[Not in 2020 HSC, examined in 2021 HSC Projectmaths]</i>	1	Solution
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NESA 2015 Mathematics General 2 HSC Examination

- 19 MS 2** **39** Two netball teams, Team A and Team B, each played 15 games in a tournament. For each team, the number of goals scored in each game was recorded. The frequency table shows the data for Team A.

The data for Team B was analysed to create the box plot below.



Number of goals	Frequency
19	1
20	0
21	1
22	1
23	1
24	3
25	0
26	4
27	3
28	1

5 [Solution](#)

Compare the distributions of the number of goals scored by the two teams. Support your answer with the construction of a box-plot for the data for Team A.

NESA 2019 Mathematics Standard 2 HSC Examination

- SQ MS 2** **SA 2** **Band 2-3** A dataset has the following five-number summary.
If the range of the dataset is 7, what is the minimum value of the dataset?
A. 1 B. 2
C. 4 D. 5

Minimum value	?
First quartile	8
Median	9
Third quartile	11
Maximum value	12

1 [Solution](#)

NESA Mathematics Standard 2 Sample examination materials

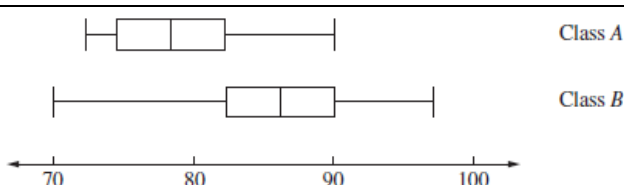
- SQ MS 2** **SA 3** **Band 2-3** A dataset has the following five-number summary.
What is the interquartile range of the dataset?
A. 1 B. 2
C. 3 D. 4

Minimum value	4
First quartile	8
Median	9
Third quartile	11
Maximum value	12

1 [Solution](#)

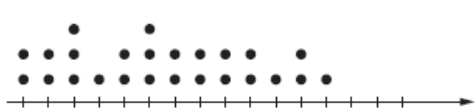
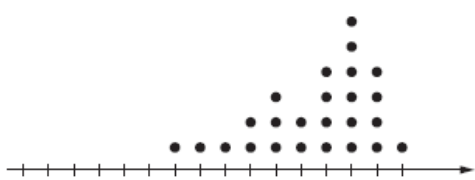
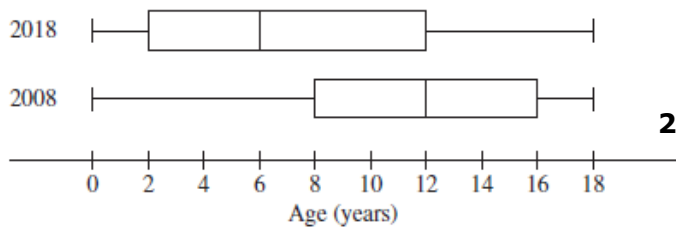
NESA Mathematics Standard 2 Sample examination materials

- SQ MS 2** **SA 10** **Band 3-4** The box-plots show the results of a test sat by two classes, A and B.
Which of the following statements is true about Class B's results when compared to those of Class A?

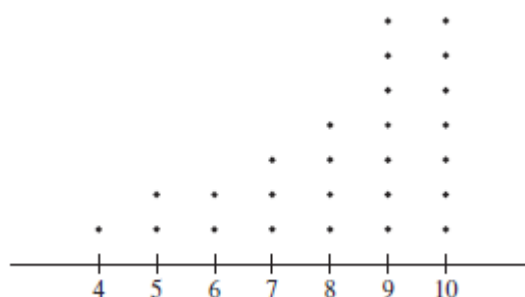


- A. The IQR for Class B's results is larger than that for Class A's results.
B. The results for Class B are more consistent than those of Class A.
C. 25% of Class B's results are higher than all of Class A's results.
D. 25% of Class B's results are lower than half of Class A's results.

NESA Mathematics Standard 2 Sample examination materials

SQ MS 2	SA 11 Band 4-5	<p>The dot plots show the class scores in tests taken before and after a unit of work was completed.</p> <p>They are drawn on the same scale.</p> <p>Which statement about the change in scores is correct?</p> <p>A. The mean increased and the standard deviation decreased. B. The mean increased and the standard deviation increased. C. The mean decreased and the standard deviation decreased. D. The mean decreased and the standard deviation increased.</p>	<p><i>Before</i></p>  <p><i>After</i></p> 	1 Solution
NESA Mathematics Standard 2 Sample examination materials				
SQ MS 2	SA 12 Band 5-6	<p>In a computer game, a player scored 180, 183, 184, 186 and 192 in the first five rounds. After playing a sixth round, the player's average score increased by 1. What was the player's score in the sixth round?</p> <p>A. 185 B. 186 C. 191 D. 193</p>	1 Solution	
NESA Mathematics Standard 2 Sample examination materials				
SQ MS 2	SA 17 Band 3-5	<p>The diagram shows the distribution of the ages of children in a town in 2008 and 2018.</p> <p>In 2008 there were 1750 children aged 0 – 18 years.</p> <p>(a) The number of children aged 12 – 18 years was the same in both 2008 and 2018. How many children aged 0 – 18 years were there in 2018?</p> <p>(b) What would be ONE possible implication for government planning as a consequence of the change in the distribution of ages from 2008 to 2018? Justify your answer with reference to the data provided.</p>	<p>Distribution of the ages of children in a town</p> 	2 Solution
NESA Mathematics Standard 2 Sample examination materials				
SQ MS 2	SA 24 Band 2-3	<p>Write down the five-number summary for the dataset 2, 4, 6, 9, 12, 18.</p>	2 Solution	
NESA Mathematics Standard 2 Sample examination materials				
18 MG	1	<p>A set of scores has the following five-number summary.</p> <p>lower extreme = 2 lower quartile = 5 median = 6 upper quartile = 8 upper extreme = 9</p> <p>What is the range?</p> <p>A. 2 B. 3 C. 6 D. 7</p>	1 Solution	
NESA 2018 Mathematics General 2 HSC Examination				

- 18 MG 6** A set of data is displayed in this dot plot. Which of the following best describes this set of data?
- A. Symmetrical
B. Positively skewed
C. Negatively skewed
D. Normally distributed

**1** [Solution](#)

NESA 2018 Mathematics General 2 HSC Examination

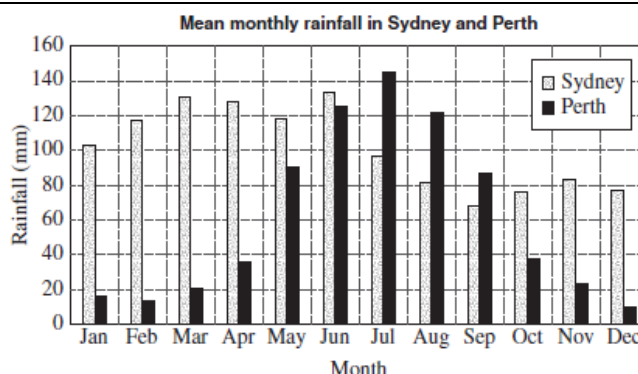
- 18 MG 11** A set of data is summarised in this frequency distribution table.
- Which of the following is true about the data?
- A. Mode = 7, median = 5.5
B. Mode = 7, median = 6
C. Mode = 9, median = 5.5
D. Mode = 9, median = 6

Score	Frequency
3	1
4	2
5	6
6	7
7	9
8	5
Total = 30	

1 [Solution](#)

NESA 2018 Mathematics General 2 HSC Examination

- 18 MG 26 d** The graph displays the mean monthly rainfall in Sydney and Perth.
- (i) For how many months is the mean monthly rainfall higher in Perth than Sydney?
- (ii) For which of the two cities is the standard deviation of the mean monthly rainfall smaller? Justify your answer WITHOUT calculations.

**1****1**

NESA 2018 Mathematics General 2 HSC Examination

- 18 MG 26 e** A cumulative frequency table for a data set is shown.
- What is the interquartile range for this data set?

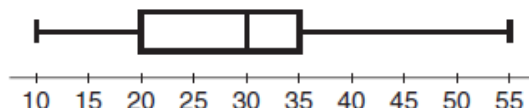
Score	Cumulative frequency
1	5
2	9
3	16
4	20
5	34
6	42

2 [Solution](#)

NESA 2018 Mathematics General 2 HSC Examination

- 17 MG** **1** The box-and-whisker plot for a set of data is shown.

1 [Solution](#)



What is the median of this set of data?

- (A) 15 (B) 20 (C) 30 (D) 35

NESA 2017 Mathematics General 2 HSC Examination

- 17 MG** **27 a** Jamal surveyed eight households in his street. He asked them how many kilolitres (kL) of water they used in the last year. Here are the results.
220, 105, 101, 450, 37, 338, 151, 205

[Solution](#)

(i) Calculate the mean of this set of data.

1

(ii) What is the population standard deviation of this set of data, correct to one decimal place?

1

NESA 2017 Mathematics General 2 HSC Examination

- 17 MG** **30 a** A set of data has a lower quartile (Q_L) of 10 and an upper quartile (Q_U) of 16. What is the maximum possible range for this set of data if there are no outliers?

2 [Solution](#)

NESA 2017 Mathematics General 2 HSC Examination

- 16 MG** **19** A soccer referee wrote down the number of goals scored in 9 different games during the season.

1 [Solution](#)

2, 3, 3, 3, 5, 5, 8, 9,

The last number has been omitted. The range of the data is 10.

What is the five-number summary for this data set?

- (A) 2, 3, 5, 8.5, 12 (B) 2, 3, 5, 8.5, 10 (C) 2, 3, 5, 8, 12 (D) 2, 3, 5, 8, 10

NESA 2016 Mathematics General 2 HSC Examination

- 16 MG** **21** A grouped data frequency table is shown. What is the mean for this set of data?

1 [Solution](#)

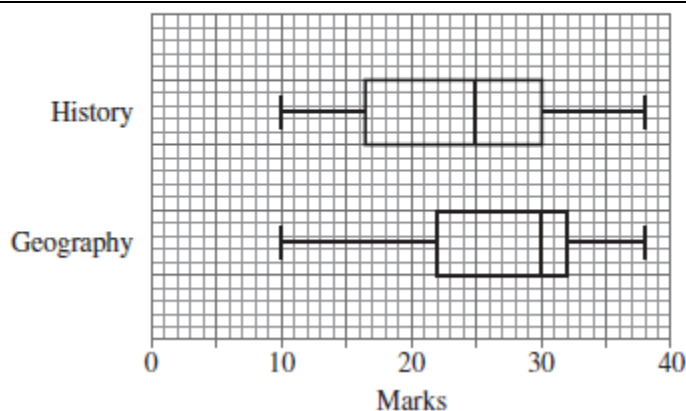
- (A) 6.5
(B) 10.5
(C) 11.9
(D) 12.4

Class interval	Frequency
1–5	3
6–10	6
11–15	8
16–20	9

NESA 2016 Mathematics General 2 HSC Examination

- 16 MG** **22** The box-and-whisker plots show the results of a History test and a Geography test.
In History, 112 students completed the test.
The number of students who scored above 30 marks was the same for the History test and the Geography test.
How many students completed the Geography test?

1 [Solution](#)



- (A) 8 (B) 50
(C) 56 (D) 112

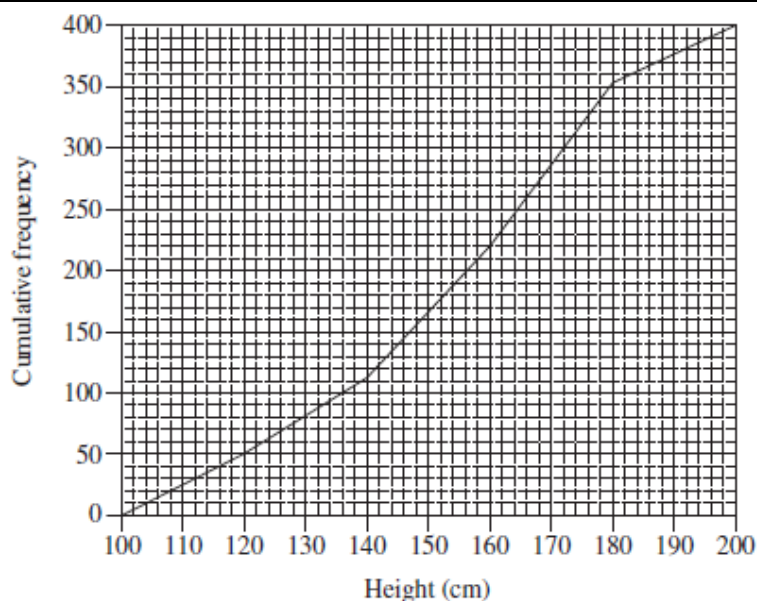
NESA 2016 Mathematics General 2 HSC Examination

- 16 MG** **27 b** A small population consists of three students of heights 153 cm, 168 cm and 174 cm. Samples of varying sizes can be taken from this population. What is the mean of the mean heights of all the possible samples? Justify your answer.

2 [Solution](#)

NESA 2016 Mathematics General 2 HSC Examination

- 16 MG** **27 c** The heights of 400 students were measured.
- The results are displayed in this cumulative frequency polygon.
- Use the polygon to estimate the interquartile range.

**2** [Solution](#)

NESA 2016 Mathematics General 2 HSC Examination

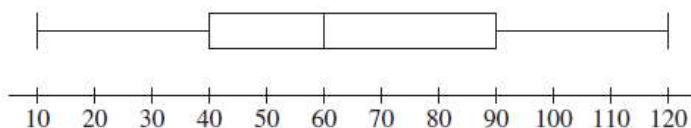
- 16 MG** **29 c** The ages of members of a dance class are shown in the back-to-back stem-and-leaf plot. Pat claims that the women who attend the dance class are generally older than the men. Is Pat correct? Justify your answer by referring to the median and skewness of the two sets of data.

Women		Men
2	3	4 6
4 2	4	2 2 5 6 8
8 8 5 4 0 0	5	3
9 4 3 3	6	3

3 [Solution](#)

NESA 2016 Mathematics General 2 HSC Examination

- 15 MG** **6** The times, in minutes, that a large group of students spend on exercise per day are presented in the box-and-whisker plot.



What percentage of these students spend between 40 minutes and 60 minutes per day on exercise?

(A) 17%

(B) 20%

(C) 25%

(D) 50%

NESA 2015 Mathematics General 2 HSC Examination

- 15 MG** **27 d** In a small business, the seven employees earn the following wages per week: \$300, \$490, \$520, \$590, \$660, \$680, \$970.
- (i) Is the wage of \$970 an outlier for this set of data? Justify your answer with calculations. **2**
- (ii) Each employee receives a \$20 pay increase. What effect will this have on the standard deviation? **1**

[Solution](#)

NESA 2015 Mathematics General 2 HSC Examination

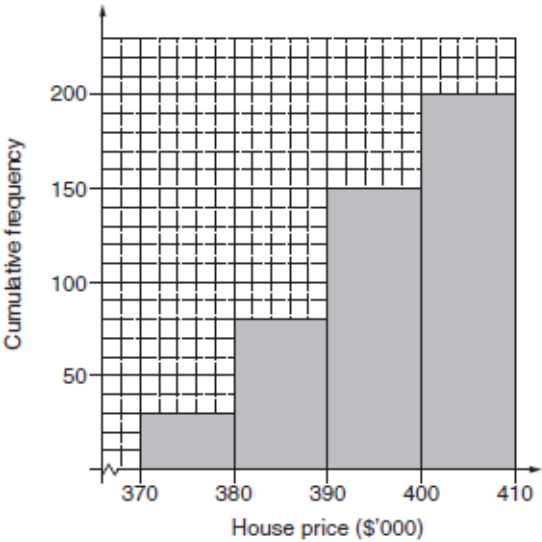
15 **29** Data from 200 recent house sales are grouped into class intervals and a cumulative frequency histogram is drawn.

MG **d**

(i) Use the graph to estimate the median house price.

(ii) By completing the table, calculate the mean house price.

<i>Class Centre (\$'000)</i>	<i>Frequency</i>



1












3

[Solution](#)

Year 12: MS – M: Measurement

M7: Rates and ratio


Syllabus: updated November 2019. Latest version @
<https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-standard-2017>
Students:

- use rates to solve and describe practical problems **AAM**
 - use rates to make comparisons, eg using unit prices to compare best buys, working with speed, comparing heart rates after exercise and considering target heart rate ranges during training  
 - know that a watt (W) is the International System of Units (SI) derived unit of power and is equal to one joule per second
 - interpret the energy rating of household appliances and compare running costs of different models of the same type of appliance, considering costs of domestic electricity, eg calculate the cost of running a 200-watt television for six hours if the average peak rate for domestic electricity is \$0.15/kWh 
 - investigate local council requirements for energy-efficient housing 
 - calculate the amount of fuel used on a trip, given the fuel consumption rate, and compare fuel consumption statistics for various vehicles
- solve practical problems involving ratio, for example capture-recapture, mixtures for building materials or cost per item **AAM**  
 - work with ratio to express a ratio in simplest form, to find the ratio of two quantities and to divide a quantity in a given ratio
 - use ratio to describe map scales
- obtain measurements from scale drawings, including maps (including cultural mappings or models) or building plans, to solve problems **AAM**  
 - interpret commonly used symbols and abbreviations on building plans and elevation views 
 - calculate the perimeter or area of a section of land, using the Trapezoidal rule where appropriate, from a variety of sources, including a site plan, an aerial photograph, radial surveys or maps that include a scale 
 - calculate the volume of rainfall over an area, using $V = Ah$, from a variety of sources, including a site plan, an aerial photograph, radial surveys or maps that include a scale 

[Reference Sheet](#)

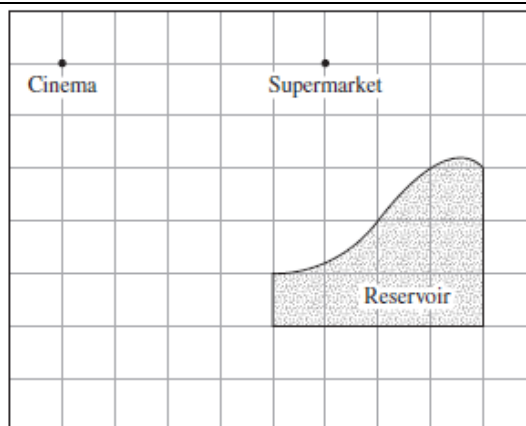
19 MS 2	2	Sugar is sold in four different sized packets. Which is the best buy? A. 100 g for \$0.40 B. 500 g for \$1.65 C. 1 kg for \$3.50 D. 2 kg for \$6.90	1	Solution
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NESA 2019 Mathematics Standard 2 HSC Examination

19 MS 2	18	Andrew, Brandon and Cosmo are the first three batters in the school cricket team. In a recent match, Andrew scored 30 runs, Brandon scored 25 runs and Cosmo scored 40 runs. (a) What is the ratio of Andrew's to Brandon's to Cosmo's runs, in simplest form? (b) In this match, the ratio of the total number of runs scored by Andrew, Brandon and Cosmo to the total number of runs scored by the whole team is 19:36. How many runs were scored by the whole team?	2 2	Solution
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NESA 2019 Mathematics Standard 2 HSC Examination

- 19 MS 2** **41** A map is drawn to scale, on 1-cm grid paper, showing the positions of a supermarket and a cinema. A reservoir is also shown.



- (a) It takes 10 minutes to walk in a straight line from the cinema to the supermarket at a constant speed of 3 km/h. Show that the scale of the map is 1 cm = 100 m.

- (b) The reservoir is initially empty. During a storm 20 mm falls on the reservoir. With the aid of one application of the trapezoidal rule, estimate the amount of water in the reservoir immediately after the storm. Assume that all rain which falls over the reservoir is stored. Give your answer in cubic metres.

3

3

[Solution](#)

NESA 2019 Mathematics Standard 2 HSC Examination

- SQ MS 2** **ME 2** There are 10 boys in a class of 25 students. What is the ratio of boys to girls in the class?

1

[Solution](#)

A. 2:3

B. 2:5

C. 3:2

D. 5:2

Band 2-3

NESA Mathematics Standard 2 Sample examination materials

- SQ MS 2** **ME 6** A car travels 560 km on 60 L of petrol. What is its fuel consumption?

1

[Solution](#)

A. 7.3 L/100 km

B. 8.7 L/100 km

C. 9.3 L/100 km

D. 10.7 L/100 km

Band 2-5

NESA Mathematics Standard 2 Sample examination materials

- SQ MS 2** **ME 16** The diagram shows the shape and dimensions of an outdoor area which is to be tiled.

4

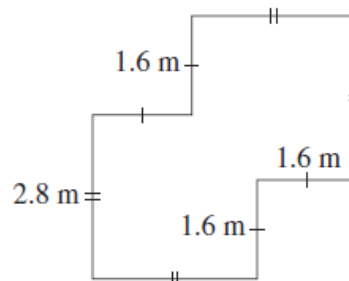
[Solution](#)

Tiles are sold in boxes. Each box holds one square metre of tiles.

When calculating the number of tiles required, 10% more tiles are needed due to cutting and wastage.

Delivery of tiles is charged at a base rate of \$55, plus a handling fee of \$8 per box.

Find the total cost of delivering the boxes of tiles required for this area.



NOT TO SCALE

NESA Mathematics Standard 2 Sample examination materials

- SQ MS 2** **ME 21** A student travels to and from university five days each week. She compares the costs of two different modes of travel.

3

[Solution](#)

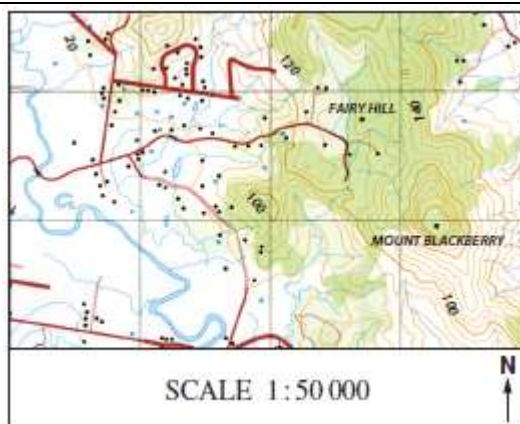
Her motorcycle uses one litre of fuel for every 17 km travelled. The cost of fuel is \$1.47/L and the distance from her home to the university car park is 34 km.

The cost of travelling by bus is \$4.71 per trip.

Which mode of travel is cheaper per week and by how much? Support your answer with calculations.

NESA Mathematics Standard 2 Sample examination materials

- SQ** **ME** Part of a map is shown.
- MS** **22** (a) What is the actual distance
2 **Band** between Mount Blackberry and
2-4 Fairy Hill, in kilometres?
(Projectmaths: the actual
distance on the paper is 2 cm)
- (b) Two bridges, not shown on this
part of the map, are 7.5 km
apart. How far apart on the
map would be the two bridges
be, in centimetres?



2

2

[Solution](#)

NESA Mathematics Standard 2 Sample examination materials

- SQ** **ME** In a raffle, the total prize money is shared among the first three tickets drawn in
2 **MS** **23** the ratio 5:3:2.
2 **Band** The prize for the third ticket drawn is \$300.
3-4 What is the total prize money?

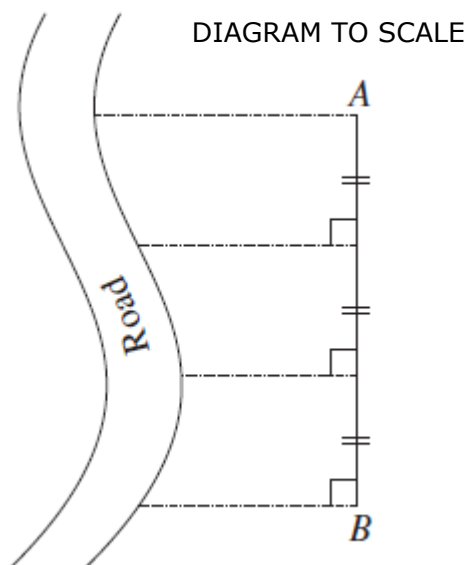
2

[Solution](#)

NESA Mathematics Standard 2 Sample examination materials

- SQ** **ME** The scale diagram shows the
2 **MS** **28** aerial view of a block of land
2 **Band** bounded on one side by a
d2-5 road. The length of the
block, AB , is known to be
45 metres.
Calculate the approximate
area of the block of land,
using three applications of
the trapezoidal rule.

[A note to students from
projectmaths: Use a ruler to
measure AB as 4.5 cm]



3

[Solution](#)

NESA Mathematics Standard 2 Sample examination materials

- SQ** **ME** A researcher used the following method to estimate a population of frogs in
2 **MS** **29** 2018.
2 **Band** 4-6
- 40 frogs were caught, tagged and released.
 - Later, 160 frogs were caught at random.
 - 20 of these 160 frogs had been tagged.
 - The estimated population of frogs in 2018 was 20% less than the estimated population for 2014.
- What was the estimated population for 2014?

3

[Solution](#)

NESA Mathematics Standard 2 Sample examination materials

- TG** **1** Calculate the cost of running a 2400-watt (2.4 kW) fan heater for eight hours per
day for 30 days.
- Assume electricity is charged at \$0.18/kWh.

[Solution](#)

NESA Mathematics Standard 2 Year 12 Topic Guide: Measurement

- 18 MG 10** A biologist caught a random sample of 56 parrots in a national park. She tagged them and then released them. She later returned to the park and caught a random sample of 47 parrots. In this sample 29 had been tagged. Using the capture/recapture technique, what is the estimated number of parrots in the park?
 (A) 35 (B) 74 (C) 91 (D) 132

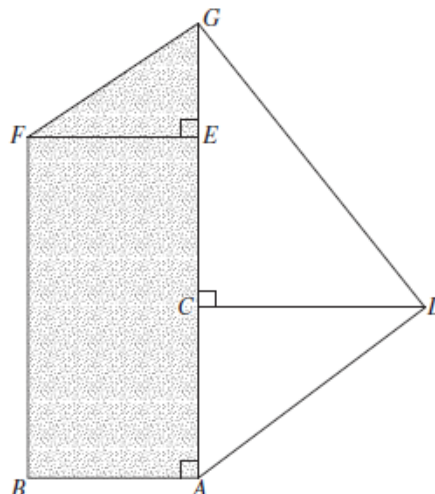
NESAs 2018 Mathematics General 2 HSC Examination

1 [Solution](#)

- 18 MG 26 g** A field diagram of a block of land has been drawn to scale. The shaded region $ABFG$ is covered with grass.

The actual length of AG is 24 m.

- (i) Show that the scale of the diagram is 1 cm = 3 m.
 (ii) How much fertiliser would be needed to fertilise the grassed area $ABFG$ at the rate of 26.5 g/m²?

SCALE
DIAGRAM**1****3**

NESAs 2018 Mathematics General 2 HSC Examination

[Solution](#)

- 17 MG 2** A car is travelling at 95 km/h. How far will it travel in 2 hours and 30 minutes?
 (A) 38 km (B) 41.3 km (C) 218.5 km (D) 237.5 km

NESAs 2017 Mathematics General 2 HSC Examination

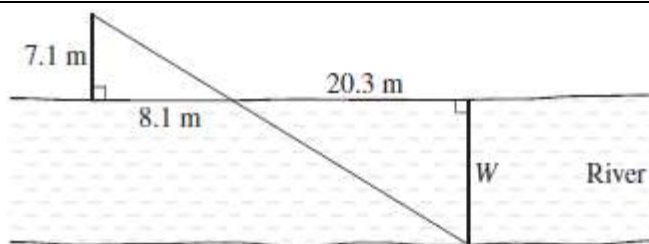
1 [Solution](#)

- 17 MG 26 c** A farmer needed to estimate the number of goats on his property. He tagged 80 of his goats. Later, he collected a random sample of 45 goats and found 16 of these had tags. Estimate the number of goats the farmer has on his property.

NESAs 2017 Mathematics General 2 HSC Examination

2 [Solution](#)

- 16 MG 16** The width (W) of a river can be calculated using two similar triangles, as shown in the diagram. What is the approximate width of the river?
 (A) 17.8 m
 (B) 19.3 m
 (C) 23.2 m
 (D) 24.9 m

NOT TO
SCALE

NOT TO SCALE

NESAs 2016 Mathematics General 2 HSC Examination

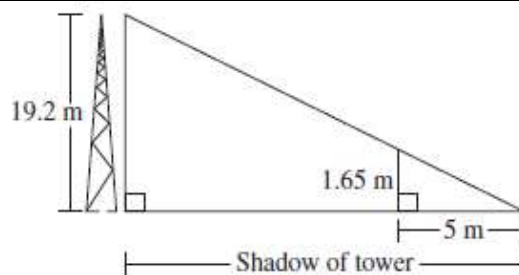
1 [Solution](#)

- 16 MG 26 c** Peta's car uses fuel at the rate of 5.9 L/100 km for country driving and 7.3 L/100 km for city driving. On a trip, she drives 170 km in the country and 25 km in the city. Calculate the amount of fuel she used on this trip.

NESAs 2016 Mathematics General 2 HSC Examination

2 [Solution](#)

- 15 MG 27 a** At a particular time during the day, a tower of height 19.2 metres casts a shadow. At the same time, a person who is 1.65 metres tall casts a shadow 5 metres long. What is the length of the shadow cast by the tower at that time?



NOT TO SCALE

NESAs 2015 Mathematics General 2 HSC Examination

2 [Solution](#)

Year 12: MS – N: Networks

N2.2: Shortest paths

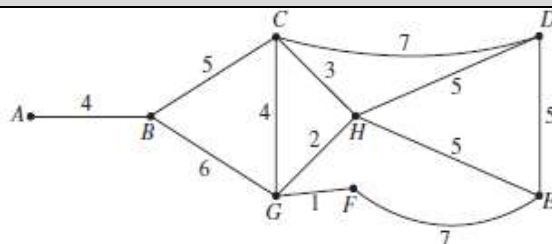
[Back](#)**Syllabus: updated November 2019. Latest version @**<https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-standard-2017>

Students:

- determine the minimum spanning tree of a given network with weighted edges **AAM**
 - determine the minimum spanning tree by using Kruskal's or Prim's algorithms or by inspection
 - determine the definition of a tree and a minimum spanning tree for a given network
 - use minimum spanning trees to solve minimal connector problems, eg minimising the length of cable needed to provide power from a single power station to substations in several towns (ACMGM103)
- find a shortest path from one place to another in a network with no more than 10 vertices **AAM**
 - identify a shortest path on a network diagram
 - recognise a circumstance in which a shortest path is not necessarily the best path or contained in any minimum spanning tree

[Reference Sheet](#)**19 MS 2**

30 The network diagram shows the tracks connecting 8 picnic sites in a nature park. The vertices *A* to *H* represents the picnic sites. The weights on the edges represent the distances along the tracks between the picnic sites, in kilometres.

[Solution](#)

- (a) Each picnic site needs to provide drinking water. The main water source is at site *A*. By drawing a minimum spanning tree in the space below, calculate the minimum length of water pipes required to supply water to all the sites if the water pipes can only be laid along the tracks. **2**
- (b) One day the track between *C* and *H* is closed. State the vertices that identify the shortest path from *C* to *E* that avoids the closed track. **1**

NESA 2019 Mathematics Standard 2 HSC Examination

SQ MS 2**NW 2**
Band 2-3

In a town, there are four petrol stations *W*, *X*, *Y* and *Z*. The table shows the length, in metres, of roads connecting these petrol stations. A petrol tanker needs to visit each station. What is the shortest distance it can travel if it starts at Station *W*?

A. 840 m B. 1000 m
C. 1120 m D. 1270 m

	<i>W</i>	<i>X</i>	<i>Y</i>	<i>Z</i>
<i>W</i>	–	650	–	280
<i>X</i>	650	–	500	220
<i>Y</i>	–	500	–	340
<i>Z</i>	280	220	340	–

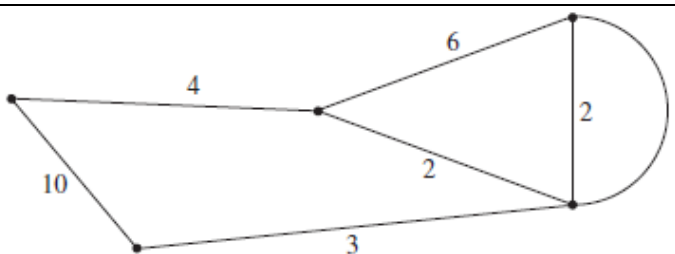
1[Solution](#)

NESA Mathematics Standard 2 Sample examination materials

SQ MS 2**NW 3**
Band 2-3

A weighted network diagram is shown below. What is the weight of the minimum spanning tree?

A. 10
B. 11
C. 12
D. 14

**1**[Solution](#)

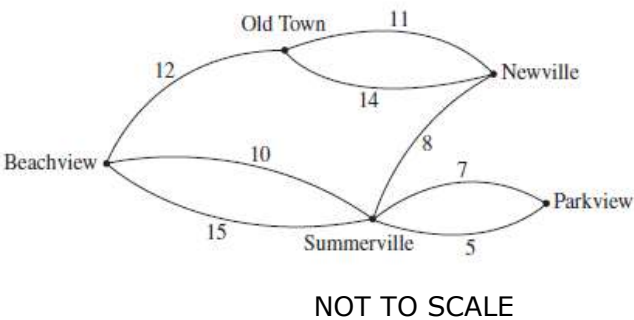
NESA Mathematics Standard 2 Sample examination materials

SQ
MS
2

NW
4
Band
2-3

This diagram shows the possible paths (in km) for laying gas pipes between various locations. Gas is to be supplied from one location. Any one of the locations can be the source of the supply. What is the minimum length of the pipes required to provide gas to all locations?

A. 32 km B. 34 km
C. 36 km D. 38 km



1 [Solution](#)

NESA Mathematics Standard 2 Sample examination materials

SQ
MS
2

NW
7
Band
2-4

In a town, there are four petrol stations W, X, Y and Z. The table shows the length, in metres, of roads connecting these petrol stations.

(a) Construct a network diagram to represent the information in the table.

(b) A petrol tanker needs to visit each station.

Calculate the shortest distance that can be travelled by the petrol tanker. In your answer, include the order that the petrol stations are refilled.

	W	X	Y	Z
W	–	650	–	280
X	650	–	500	220
Y	–	500	–	340
Z	280	220	340	–

2 [Solution](#)

NESA Mathematics Standard 2 Sample examination materials

SQ
MS
2

NW
8
Band
2-5

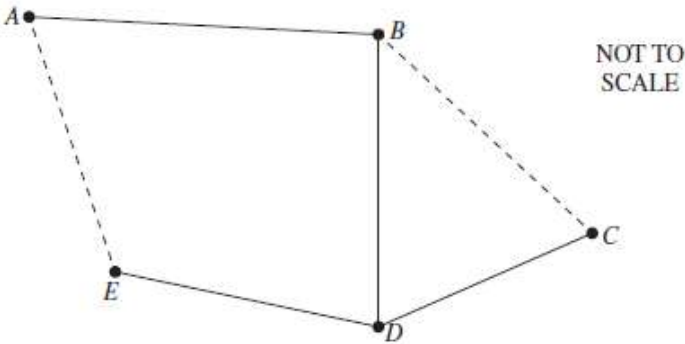
A park has five areas, A, B, C, D and E, which are connected by pathways.

The table shows the length of some of the pathways, in metres.

The following network diagram is drawn to represent this information and a correct minimum spanning tree is shown by the solid lines.

Complete the network diagram including a possible value for each of the two edges AE and BC, and justify why AE and BC were not included as part of the minimum spanning tree.

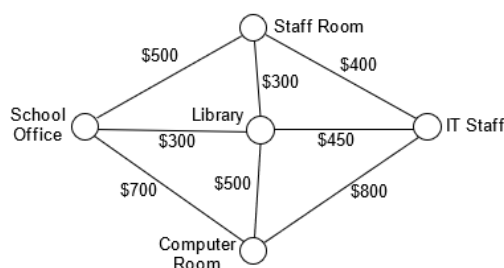
	A	B	C	D	E
A	–	600	–	–	?
B	600	–	?	500	–
C	–	?	–	400	–
D	–	500	400	–	300
E	?	–	–	300	–



4 [Solution](#)

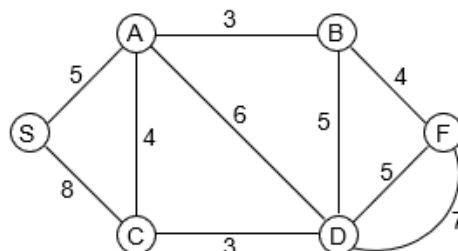
NESA Mathematics Standard 2 Sample examination materials

- TG 1** A computer network is to be built in a school. The rooms and the cost of connecting the rooms are shown in the diagram. Using a minimum spanning tree, determine the smallest cost to connect all the rooms.

[Solution](#)

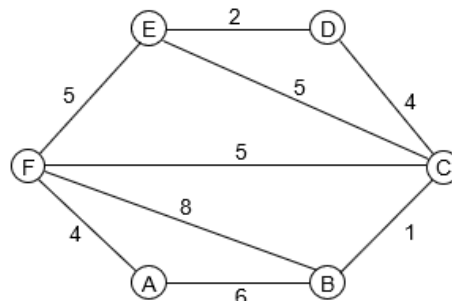
NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 2** Draw the minimum spanning tree for this network.

[Solution](#)

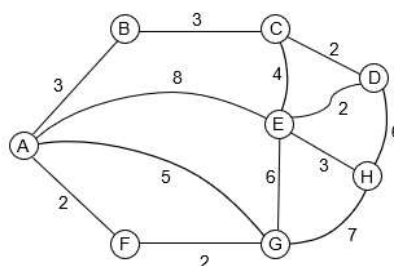
NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 3** Draw the minimum spanning tree for this network.

[Solution](#)

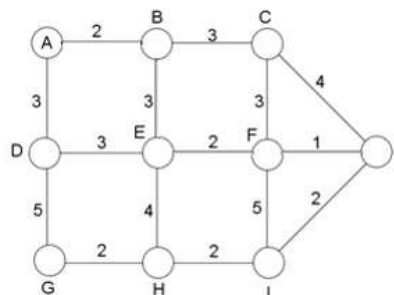
NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 4** Identify the shortest distance from A to H.

[Solution](#)

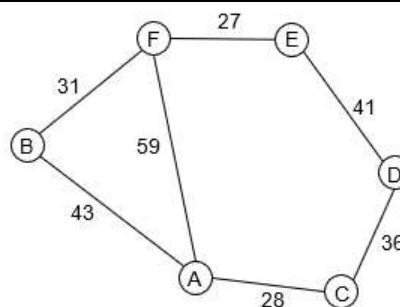
NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 5** Identify the shortest distance from A to J.

[Solution](#)

NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 6** Determine the weight of the minimum spanning tree for this network.

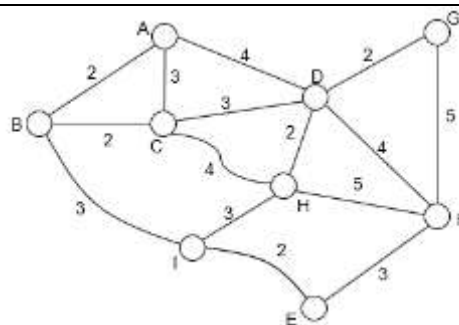
[Solution](#)

NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 7** Consider the following network.

[Solution](#)

- (a) Determine the minimum spanning tree.
- (b) Find the length of the shortest path from A to E in the network.



NESA Mathematics Standard 2 Year 12 Topic Guide: Networks

- TG 8** The following table shows the travelling times in minutes between towns which are connected directly to each other.
- Note:* The dash in a box indicates that towns are not connected directly to each other.
- (a) Draw a network diagram showing the information on this table.
- (b) Find the shortest travelling time between A and E.

[Solution](#)

	A	B	C	D	E
A	0	50	20	25	-
B	50	0	25	30	30
C	20	25	0	-	60
D	25	30	-	0	70
E	-	30	60	70	0

NESA Mathematics Standard 2 Year 12 Topic Guide: Networks



NSW Education Standards Authority

2020 HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 1

Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

Absolute error = $\frac{1}{2} \times \text{precision}$

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

Length

$$l = \frac{\theta}{360} \times 2\pi r$$

Area

$$A = \frac{\theta}{360} \times \pi r^2$$

$$A = \frac{h}{2}(a + b)$$

$$A \approx \frac{h}{2}(d_f + d_l)$$

Surface area

$$A = 2\pi r^2 + 2\pi rh$$

$$A = 4\pi r^2$$

Volume

$$V = \frac{1}{3}Ah$$

$$V = \frac{4}{3}\pi r^3$$

Trigonometry

$$\sin A = \frac{\text{opp}}{\text{hyp}}, \quad \cos A = \frac{\text{adj}}{\text{hyp}}, \quad \tan A = \frac{\text{opp}}{\text{adj}}$$

$$A = \frac{1}{2}ab \sin C$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Financial Mathematics

$$FV = PV(1 + r)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0(1 - r)^n$$

Statistical Analysis

An outlier is a score

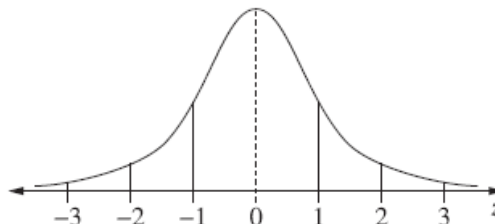
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

$$z = \frac{x - \mu}{\sigma}$$

Normal distribution



- approximately 68% of scores have z-scores between -1 and 1
- approximately 95% of scores have z-scores between -2 and 2
- approximately 99.7% of scores have z-scores between -3 and 3