



MATHEMATICS STANDARD 1

HSC Exam* Questions by Topic

2019 - 2015

v2020

Licensed
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

A3.1: Simultaneous Linear Equations

A3.2: Graphs of practical situations

Measurement

M3: Right-angled triangles

[M4: Rates](#)

M5: Scale drawings

Financial Mathematics

F2: Investments

F3: Depreciation and loans

Statistical Analysis

S3.1: Statistical investigation process

S3.2: Exploring data from 2 variables

Networks and Paths

N2.1: Networks

[N2.2: Shortest paths](#)

[Mathematics Standard 1 Reference Sheet \(2020 HSC\)](#)

Questions by Topic from ...

- 2019 Mathematics Standard 1 HSC
- NESAs Mathematics Standard 1 Sample exam questions [SQ] (2019)
- Selected NESAs Topic Guidance questions [TG] (2018)
- 2018 – 2015 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 MS 1** **2** What is the time difference between 8:35 am and 2:10 pm? **1** [Solution](#)
- A. 5 hours and 25 minutes
B. 5 hours and 35 minutes
C. 6 hours and 25 minutes
D. 6 hours and 35 minutes

NESAS 2019 Mathematics Standard 1 HSC Examination

- SQ MS** **ME 5** **Band 3-5** Part of a train timetable is shown. 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

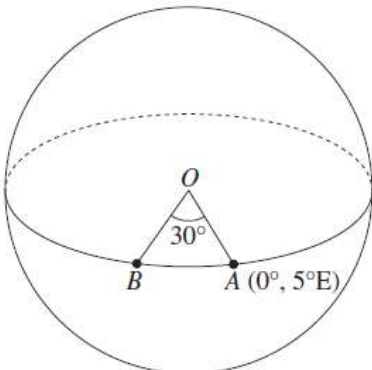
Amesham	13.37	13.47	...	13.55
Bickford	13.43	...	14.00	14.02
Clipsbury	...	14.02	...	14.11
Doppleton	14.05	14.12	14.20	14.24
Evesbury	14.17	14.29	...	14.43
Frampton	14.38	...	14.47	14.55

1 [Solution](#)

NESAS Mathematics Standard 1 Sample examination materials

- SQ MS** **ME 18** **Band 3-5** Karin is in Athens, which is two hours ahead of Coordinated Universal Time (UTC). Marco is in New York, which is five hours behind UTC. [Solution](#)
- (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 Wednesday at 9 am, New York time, and will take 11 hours. **2**
What day and time will it be in Athens when he arrives?

NESAS Mathematics Standard 1 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
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 1</i>	1	Solution
				
		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
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
NESA 2015 Mathematics General 2 HSC Examination				

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

- describe the distinguishing features of a population and sample
 - define notations associated with population values (parameters) and sample-based estimates (statistics), including population mean μ , population standard deviation σ , sample mean \bar{x} and sample standard deviation s
- summarise and interpret grouped and ungrouped data through appropriate graphs and summary statistics **AAM**
 - discuss the mode and determine where possible
 - calculate measures of central tendency, including the arithmetic mean and the median (ACMEM050)
 - investigate the suitability of measures of central tendency in real-world contexts and use them to compare datasets
 - calculate measures of spread including the range, quantiles (including quartiles, deciles and percentiles), interquartile range (IQR) and standard deviation (calculations for standard deviation are only required by using technology)
- investigate and describe the effect of outliers on summary statistics
 - use different approaches for identifying outliers, including consideration of the distance from the mean or median, or the use of $Q_1 - 1.5 \times IQR$ and $Q_3 + 1.5 \times IQR$ as criteria, recognising and justifying when each approach is appropriate
 - investigate and recognise the effect of outliers on the mean and median
- investigate real-world examples from the media illustrating appropriate and inappropriate uses or misuses of measures of central tendency and spread (ACMEM056) **AAM**
- describe, compare and interpret the distributions of graphical displays and/or numerical datasets and report findings in a systematic and concise manner **AAM**
 - identify modality (unimodal, bimodal or multimodal)
 - identify shape (symmetric or positively or negatively skewed)
 - identify central tendency, spread and outliers, using and justifying appropriate criteria
 - calculate measures of central tendency or measures of spread where appropriate
- construct and compare parallel box-plots **AAM**
 - complete a five-number summary for different datasets (ACMEM058)
 - compare groups in terms of central tendency (median), spread (IQR and range) and outliers (using appropriate criteria)
 - interpret and communicate the differences observed between parallel box-plots in the context of the data

Reference Sheet

19 MS 1 The heights, in centimetres, of 10 players on a basketball team are shown.
170, 180, 185, 188, 192, 193, 193, 194, 196, 202
Is the height of the shortest player on the team considered an outlier?
Justify your answer with calculations.

3 Solution

NESA 2019 Mathematics Standard 1 HSC Examination

- SQ MS** **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 1 Sample examination materials

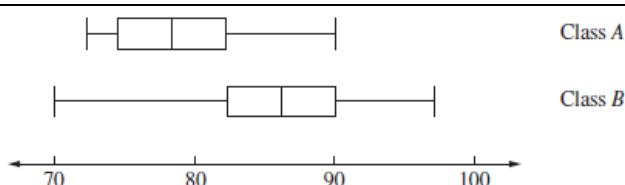
- SQ MS** **SA 3**
Band 2-3
- A dataset has the following five-number summary.
What is the interquartile range of the dataset?
- A. 1 B. 2
C. 3 D. 4

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

1 [Solution](#)

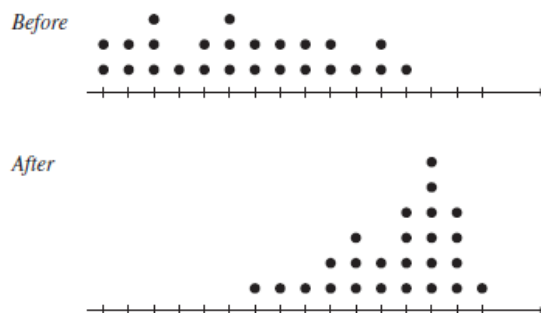
NESA Mathematics Standard 1 Sample examination materials

- SQ MS** **SA 10**
Band 4-5
- 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.

**1** [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

- SQ MS** **SA 11**
Band 5-6
- The dot plots show the class scores in tests taken before and after a unit of work was completed.

**1** [Solution](#)

They are drawn on the same scale.

Which statement about the change in scores is correct?

- 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.

NESA Mathematics Standard 1 Sample examination materials

- SQ MS** **SA 12**
Band 5-6
- 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?
- A. 185 B. 186 C. 191 D. 193

1 [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

SQ MS	SA 17 Band 3-6	<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>2</p> <p>2</p>	Solution
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NESA Mathematics Standard 1 Sample examination materials

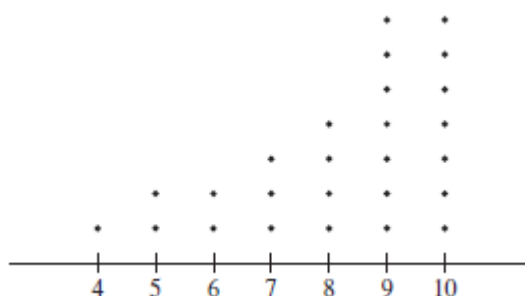
SQ MS	SA 24 Band 3-4	Write down the five-number summary for the dataset 2, 4, 6, 9, 12, 18.	2	Solution
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NESA Mathematics Standard 1 Sample examination materials

18 MG	1	<p>A set of scores has the following five-number summary.</p> <p>lower extreme = 2 lower quartile = 5 median = 6</p> <p>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
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NESA 2018 Mathematics General 2 HSC Examination

18 MG	6	<p>A set of data is displayed in this dot plot.</p> <p>Which of the following best describes this set of data?</p> <p>A. Symmetrical</p> <p>B. Positively skewed</p> <p>C. Negatively skewed</p> <p>D. Normally distributed</p>	1	Solution
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NESA 2018 Mathematics General 2 HSC Examination

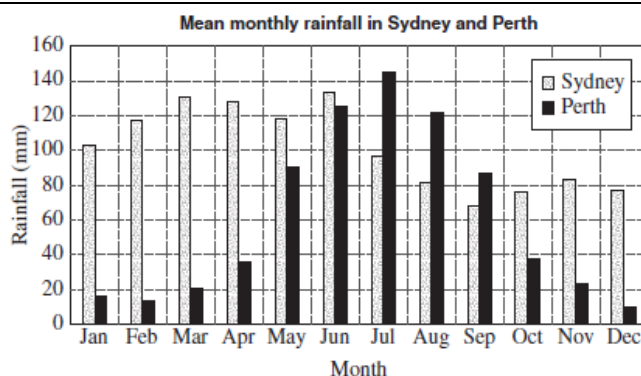
18 MG	11	<p>A set of data is summarised in this frequency distribution table.</p> <p>Which of the following is true about the data?</p> <p>A. Mode = 7, median = 5.5</p> <p>B. Mode = 7, median = 6</p> <p>C. Mode = 9, median = 5.5</p> <p>D. Mode = 9, median = 6</p>	1	Solution
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Score	Frequency
3	1
4	2
5	6
6	7
7	9
8	5
Total = 30	

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.

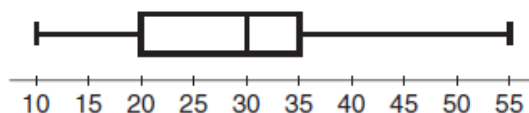
What is the interquartile range for this data set?

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.



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

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

1
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?

NESA 2017 Mathematics General 2 HSC Examination

2 [Solution](#)

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

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

1 [Solution](#)

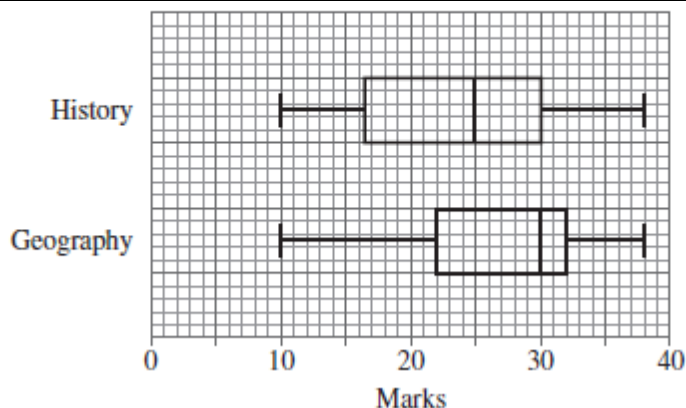
- 16 MG 21** A grouped data frequency table is shown. What is the mean for this set of data?
 (A) 6.5
 (B) 10.5
 (C) 11.9
 (D) 12.4

<i>Class interval</i>	<i>Frequency</i>
1–5	3
6–10	6
11–15	8
16–20	9

1 [Solution](#)

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

**1** [Solution](#)

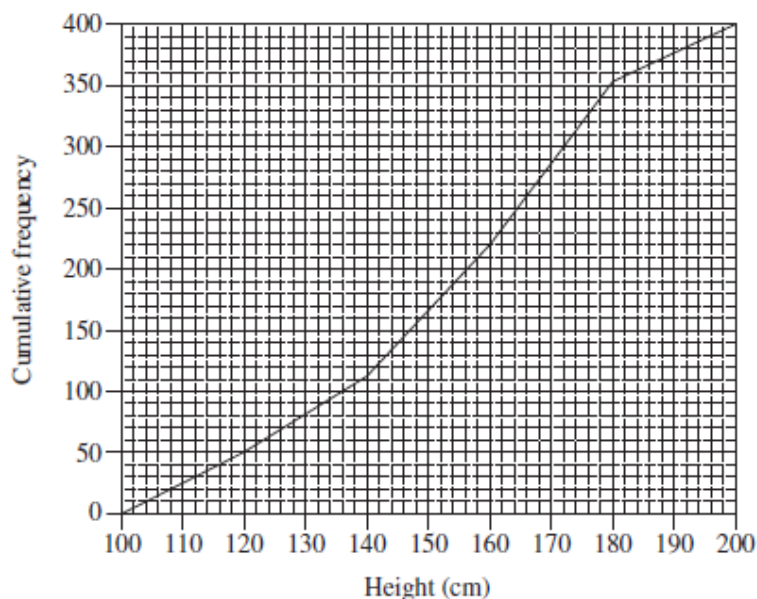
NESA 2016 Mathematics General 2 HSC Examination

- 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

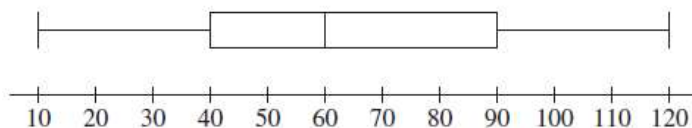
- 16 MG** **29 c** The ages of members of a dance class are shown in the back-to-back stem-and-leaf plot. Pat claims that the women who attend the dance class are generally older than the men. Is Pat correct? Justify your answer by referring to the median and skewness of the two sets of data.

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.

[Solution](#)

- (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**

NESA 2015 Mathematics General 2 HSC Examination

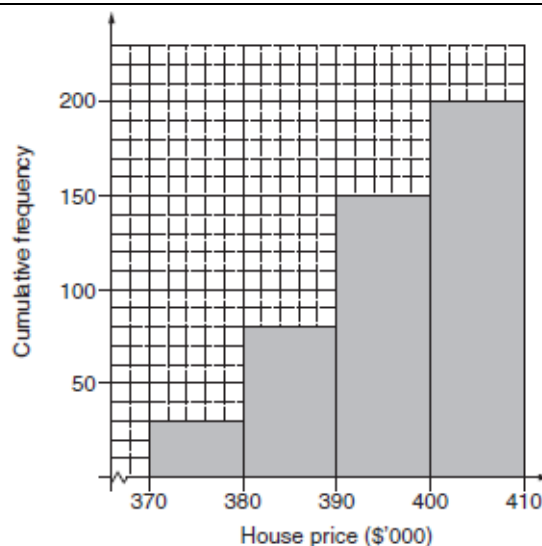
- 15 MG** **29 d** Data from 200 recent house sales are grouped into class intervals and a cumulative frequency histogram is drawn.

[Solution](#)

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

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

Class Centre (\$'000)	Frequency

**1****3**

NESA 2015 Mathematics General 2 HSC Examination

Year 12: MS – M: Measurement

M4: Rates



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>

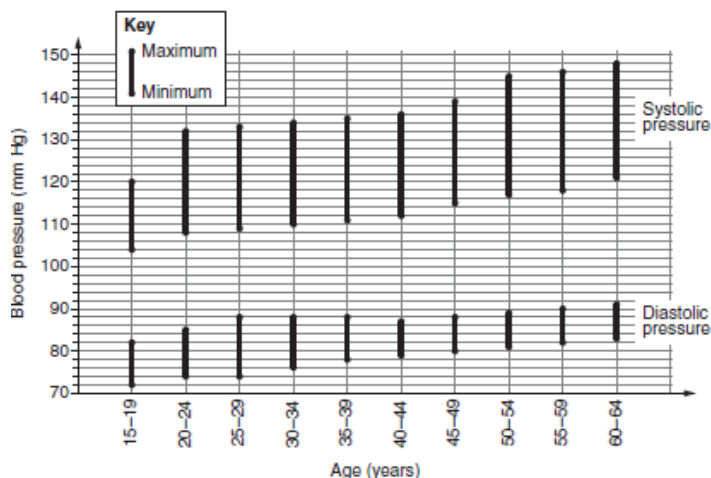
Students:

- use, simplify and convert between units of rates, for example km/h and m/s, mL/min and L/h (ACMEM071, ACMEM072)
- use rates to solve practical problems **AAM**
 - use rates to make comparisons, eg using unit prices to compare best buys, comparing heart rates after exercise (ACMEM016, ACMEM074) ⚙️ 📊 📈
 - use rates to determine costs, eg calculating the cost of a trade professional using rates per hour and call-out fees (ACMEM075) ⚙️ 📊 📈
 - work with speed as a rate, including interpreting distance-time graphs (travel graphs) and use them to solve problems related to speed, distance and time ⚙️ 📊 📈
 - calculate the amount of fuel used on a trip, given the fuel consumption rate, and compare fuel consumption statistics for various vehicles
- solve problems involving heart rates and blood pressure **AAM**
 - describe heart rate as a rate expressed in beats per minute
 - measure and graph a person's heart rate over time under different conditions and identify mathematical trends 📊
 - calculate target heart rate ranges during training 📊
 - express blood pressure using measures of systolic pressure and diastolic pressure
 - measure blood pressure over time and under different conditions
 - use a blood pressure chart and interpret the 'healthiness' of a reading 📊

[Reference Sheet](#)

19 MS 1	3	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 NESA 2019 Mathematics Standard 1 HSC Examination	1	Solution
19 MS 1	5	Which expression can be used to convert a speed of 3 metres per minute to a speed in centimetres per second? A. $3 \times 100 \div 60$ B. $3 \times 100 \times 60$ C. $3 \div 100 \div 60$ D. $3 \div 100 \times 60$ NESA 2019 Mathematics Standard 1 HSC Examination	1	Solution

- 19 MS 1** **6** When blood pressure is measured, two numbers are recorded: systolic pressure and diastolic pressure. If the measurements recorded are 130 systolic and 85 diastolic, then the blood pressure is written as '130 over 85'. The bars on the graph indicate the healthy ranges of blood pressure for people of various ages. Which person has both blood pressure measurements in the healthy range for their age?
- A. Stella aged 23 with blood pressure 120 over 72
 B. Shane aged 35 with blood pressure 124 over 90
 C. Jon aged 54 with blood pressure 137 over 94
 D. Annie aged 61 with blood pressure 142 over 88



NESA 2019 Mathematics Standard 1 HSC Examination

- 19 MS 1** **8** Heart rate is measured in beats per minute. Maximum heart rate (MHR) is calculated using the following formula.

$$\text{MHR} = 220 - \text{age}$$
 Target heart rates are calculated as a percentage of MHR. Felicity's age is 28. Her trainer calculates that her target heart rate range is 60% to 80% of her MHR. Which of the following lies within this target heart rate range?
- A. 100 beats per minute
 B. 140 beats per minute
 C. 180 beats per minute
 D. 220 beats per minute

NESA 2019 Mathematics Standard 1 HSC Examination

- 19 MS1** **29** Concrete is made by mixing cement, sand and aggregate. Different types of concrete are produced by changing the ratio of the mix of these materials. The table shows the ratio of the materials for different types of concrete and examples of their common use. The amount of concrete required for a patio slab is 3.5 cubic metres. How many cubic metres of sand will be needed?

Ratio of cement : sand : aggregate	Common use
1:2:2	Foundation for fence posts
1:3:6	Footpath, patio slab
1:1:2	House slab

NESA 2019 Mathematics Standard 1 HSC Examination

- SQ MS Band 3-4** **ME 6** A car travels 560 km on 60 L of petrol. What is its fuel consumption?
- A. 7.3 L/100 km
 B. 8.7 L/100 km
 C. 9.3 L/100 km
 D. 10.7 L/100 km

NESA Mathematics Standard 1 Sample examination materials

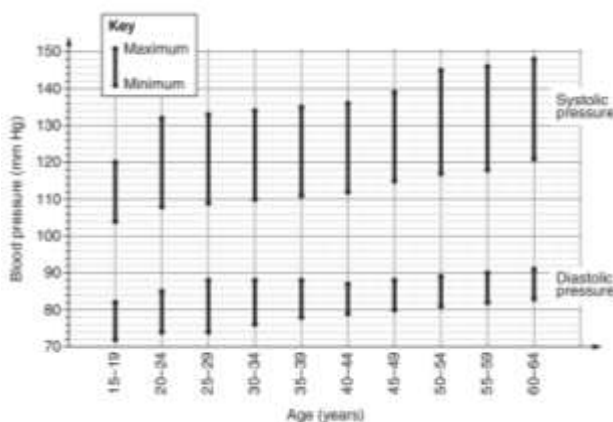
- SQ MS**
Band 3-4
- ME 12** The table shows the average energy used, in kilojoules per kilogram of body mass, by a person walking for 30 minutes at different speeds. Sam, who weighs 65 kg, drinks a regular cappuccino made with full cream milk. It contains 73 kilocalories. For approximately how long must Sam walk at 3 km/h to burn off the energy contained in the cappuccino? (1 kilocalorie = 4.184 kJ.)
- A. 20 minutes B. 25 minutes C. 90 minutes D. 120 minutes

Walking speed	Energy used in 30 minutes
3 km/h	5.53 kJ/kg
5 km/h	7.37 kJ/kg

1 [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

- SQ MS**
Band 4-5
- ME 14** Blood pressure is measured using two numbers: systolic pressure and diastolic pressure. If the measurement shows 120 systolic and 80 diastolic, it is written as '120 over 80'. The bars on the graph show the normal ranges of blood pressure for people of various ages. Jamie, aged 42, had a blood pressure of 180 over 130. A doctor prescribed Jamie a medication to reduce his blood pressure. To check that the medication was being effective, the doctor measured Jamie's blood pressure for 10 weeks and recorded the following results. Based on these results, from which week was Jamie's blood pressure consistently in the normal range?
- A. Week 4 B. Week 5 C. Week 6 D. Week 7

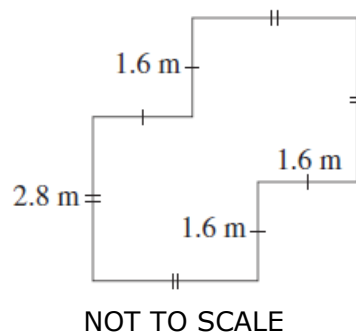


Week	1	2	3	4	5	6	7	8	9	10
Systolic pressure	180	160	152	134	140	130	130	128	131	132
Diastolic pressure	130	115	106	85	83	90	85	84	81	80

1 [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

- SQ MS**
Band 2-6
- ME 16** The diagram shows the shape and dimensions of an outdoor area which is to be tiled. 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.

**4** [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

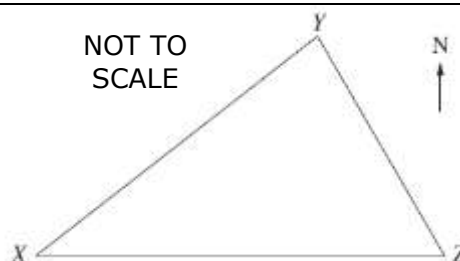
SQ
MS
Band
3-6**ME**
19

The diagram shows the three towns X, Y and Z. Town Z is due east of Town X. The bearing of Town Y from Town X is $N39^\circ E$ and the bearing of Town Z from Town Y is $S51^\circ E$.

The distance between Town X and Town Y is 1330 km.

A plane flies between the three towns.

- (a) Mark the given information on the diagram and explain why $\angle XYZ$ is 90° . **2**
- (b) Find the distance between Town X and Town Z to the nearest kilometre. **2**
- (c) If the speed of the plane is 570 km/h, how long does the flight take from Town X to Town Y, in hours and minutes? **2**

[Solution](#)

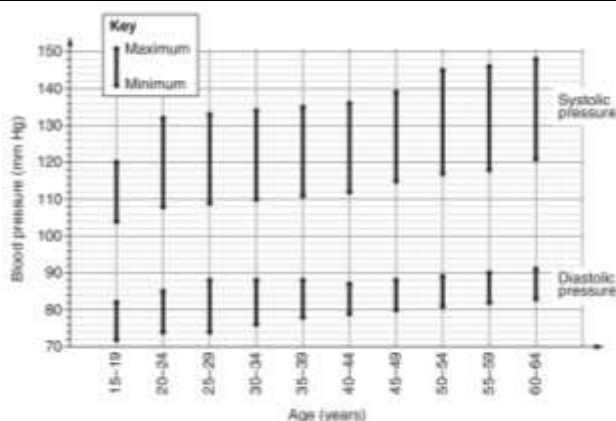
NESA Mathematics Standard 1 Sample examination materials

SQ
MS
Band
4-5**ME**
20

Blood pressure is measured using two numbers: systolic pressure and diastolic pressure. If the measurement shows 120 systolic and 80 diastolic, it is written as '120 over 80'.

The bars on the graph show the normal ranges of blood pressure for people of various ages.

- (a) What is the normal range of blood pressure for a 42-year-old? **1**
- (b) Jamie, aged 42, had a blood pressure of 180 over 130. A doctor prescribed Jamie a medication to reduce his blood pressure. To check that the medication was being effective, the doctor measured Jamie's blood pressure for 10 weeks and recorded the following results. **3**



Week	1	2	3	4	5	6	7	8	9	10
Blood pressure	180/130	160/115	152/106	154/95	140/93	130/90	130/85	128/84	131/81	132/80

With reference to the data provided, comment on the effectiveness of the medication during the 10-week period in returning Jamie's blood pressure to the normal range.

NESA Mathematics Standard 1 Sample examination materials

SQ
MS
Band
3-5**ME**
21

A student travels to and from university five days each week. She compares the costs of two different modes of travel. **3**

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. [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

TG**1**

An old washing machine uses 130 L of water per load. [Solution](#)

A new washing machine uses 50 L per load.

How much water is saved each year if two loads of washing are done each week using the new machine?

NESA Mathematics Standard 2 Year 11 Topic Guide: Measurement

17	2	A car is travelling at 95 km/h. How far will it travel in 2 hours and 30 minutes?	1	Solution
MG		(A) 38 km (B) 41.3 km (C) 218.5 km (D) 237.5 km		
NESA 2017 Mathematics General 2 HSC Examination				
16	26c	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.	2	Solution
MG				
NESA 2016 Mathematics General 2 HSC Examination				

Year 12: MS – N: Networks

N2.2: Shortest paths



Syllabus: updated November 2019. Latest version @

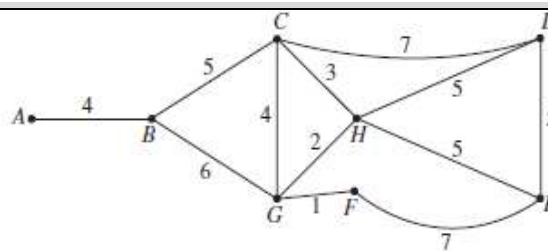
<https://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-standard-2017>

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
- 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 MS1** **28** 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 1 HSC Examination

- SQ MS** **NW 2** 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.

Band 3-4

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

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

1

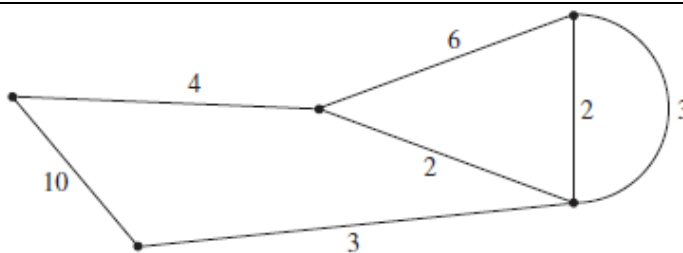
[Solution](#)

NESA Mathematics Standard 1 Sample examination materials

- SQ MS** **NW 3** A weighted network diagram is shown below. What is the weight of the minimum spanning tree?

Band 3-4

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



1

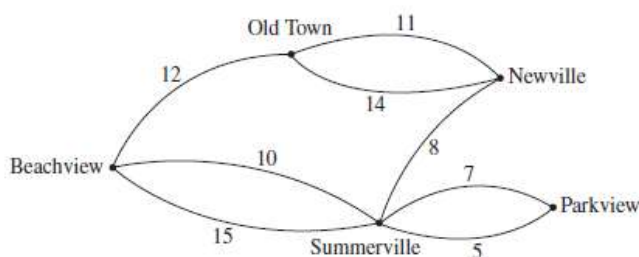
[Solution](#)

NESA Mathematics Standard 1 Sample examination materials

SQ
MS **NW**
4
Band
3-4

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



NOT TO SCALE

1 [Solution](#)

NESA Mathematics Standard 1 Sample examination materials

SQ
MS **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

2

[Solution](#)

NESA Mathematics Standard 1 Sample examination materials

SQ
MS **NW**
8
Band
2-6

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.

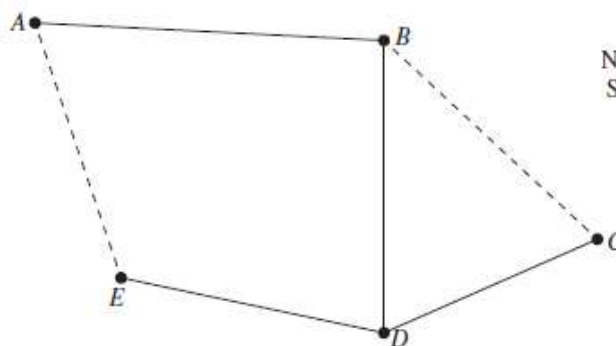
The following network diagram is drawn to represent this information and a correct minimum spanning tree is shown by the solid lines.

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

4

[Solution](#)

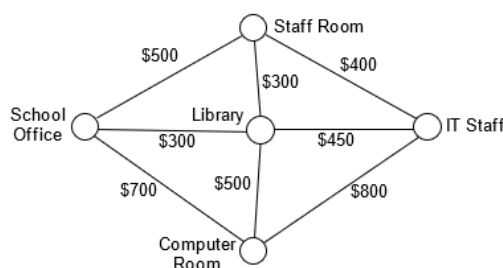
Complete the network diagram including a possible value for each of the two edges AE and BC, and justify why AE and BC were not included as part of the minimum spanning tree.



NOT TO SCALE

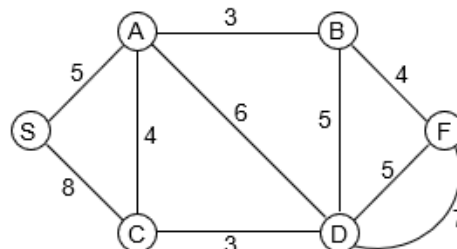
NESA Mathematics Standard 1 Sample examination materials

- 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](#)

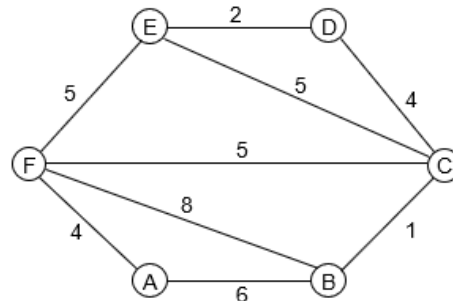
NESA Mathematics Standard 2 Year 11 Topic Guide: Networks

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

[Solution](#)

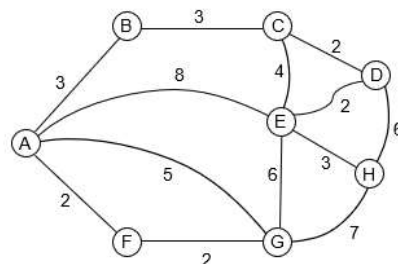
NESA Mathematics Standard 2 Year 11 Topic Guide: Networks

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

[Solution](#)

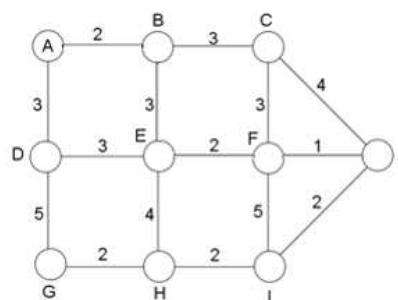
NESA Mathematics Standard 2 Year 11 Topic Guide: Networks

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

[Solution](#)

NESA Mathematics Standard 2 Year 11 Topic Guide: Networks

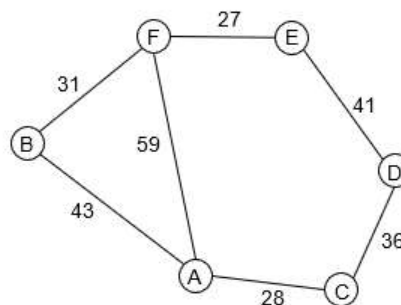
- TG 5** Identify the shortest distance from A to J.

[Solution](#)

NESA Mathematics Standard 2 Year 11 Topic Guide: Networks

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

[Solution](#)

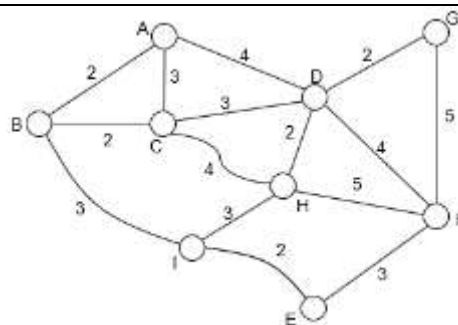


NESA Mathematics Standard 2 Year 11 Topic Guide: Networks

- 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 11 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 11 Topic Guide: Networks



NSW Education Standards Authority

2020 HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 1

Mathematics Standard 2

REFERENCE SHEET

Measurement

Limits of accuracy

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

$$\text{Upper bound} = \text{measurement} + \text{absolute error}$$

$$\text{Lower bound} = \text{measurement} - \text{absolute error}$$

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

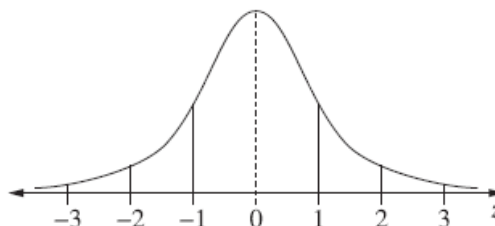
$$\text{less than } Q_1 - 1.5 \times IQR$$

or

$$\text{more than } Q_3 + 1.5 \times IQR$$

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

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