A C E
EXAM
PAPER

Student name: _____

PAPER 1

YEAR 12
YEARLY
EXAMINATION

Mathematics Standard 1

General Instructions

- Working time - 120 minutes
- Write using black pen
- NESA approved calculators may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations

Total marks: 80

Section I – 10 marks

- Attempt Questions 1-10
- Allow about 15 minutes for this section

Section II – 70 marks

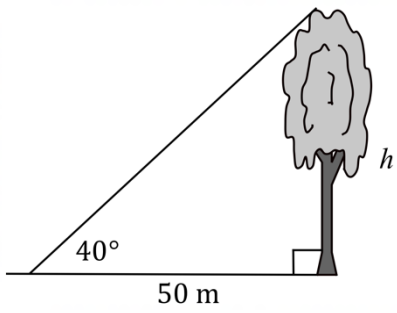
- Attempt all questions in Section II
- Allow about 1 hour and 45 minutes for this section

Section I

10 marks
Attempt questions 1 - 10
Allow about 15 minutes for this section

Use the multiple-choice answer sheet for questions 1-10

1.



Not to scale

Which of the following expressions would give the height (h), of the tree in the diagram?

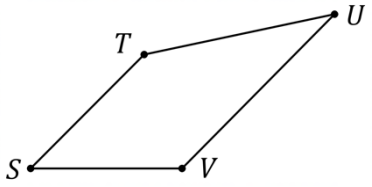
(A) $50 \times \tan 40°$

(B) $\dfrac{50}{\tan 40°}$

(C) $50 \times \cos 40°$

(D) $\dfrac{50}{\cos 40°}$

2.



Which of the following walks is a path in the above network diagram?

(A) S–T–S–V
(B) S–T–U–V
(C) S–T–V–S
(D) S–T–U–V–S

3. Ivy travels on a motorway at 100 km/h and it takes her 4 hours to get to her destination. Due to roadwork the motorway speed is reduced to 80 km/h. How long will it take Ivy to travel to her destination?

(A) 3 h
(B) 3.4 h
(C) 3.5 h
(D) 5 h

4. The scale on an aerial photograph is given as 1 mm = 180 m. If the length of land is 240 m, what is the map length between these points?

(A) 1.33 mm

(B) 2.67 mm

(C) 3.20 mm

(D) 60 mm

5. Michael invests \$3125 at 6% per annum compounding quarterly.
How much will he have after 4 years? Answer to the nearest dollar.

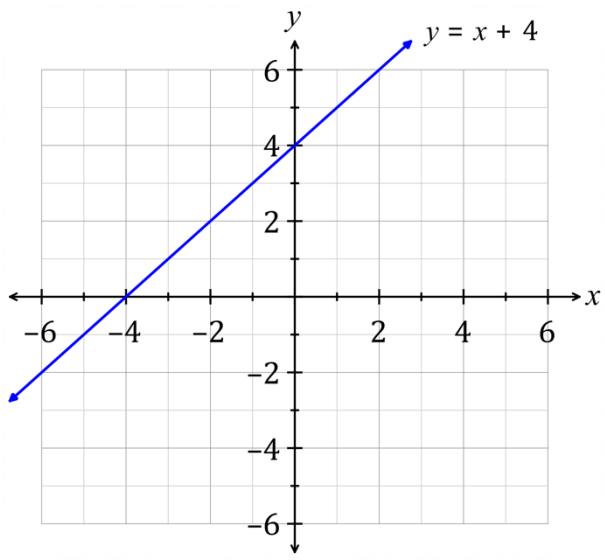
(A) \$3317

(B) \$3945

(C) \$3966

(D) \$7939

6.



The graph of $y = x + 4$ is shown above. Draw the graph of $y = -x + 4$ on the number plane.
What is the point of intersection of the lines $y = x + 4$ and $y = -x + 4$?

(A) (0, 0)

(B) (0, 4)

(C) (4, 0)

(D) (0, −4)

7. Andrew was driving at a speed of 70 km/h and has reaction time of 0.50 seconds. What is the stopping distance using the formula below?

$$d = \frac{5vt}{18} + \frac{v^2}{170}$$

(A) 12 m

(B) 24 m

(C) 39 m

(D) 44 m

8. The length of child's foot increases until they reach adulthood. What is the best description for the relationship between foot length and a child's age?

   (A) Positive association

   (B) Negative association

   (C) Extrapolation

   (D) Interpolation

9. Olive obtained a personal loan of \$30 000. She made a deposit of \$2200 and agreed to payments of \$820 per month for 4 years. What is the total amount paid for the loan?

   (A) \$9360

   (B) \$11 560

   (C) \$39 360

   (D) \$41 560

10. The number of people in a town is given by $N = 1000(2.5^t)$ where N is the number of people and t is the time in years. What is the population after 2 years?

    (A) 1581

    (B) 2500

    (C) 5000

    (D) 6250

Section II

70 marks
Attempt all questions
Allow about 1 hour and 45 minutes for this section

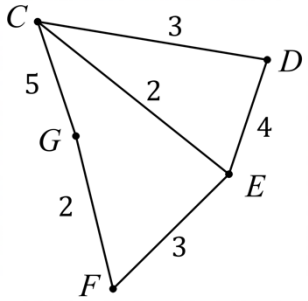
Answer each question in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.

Question 11 (2 marks) **Marks**

Alice and Layla receive 72 text messages in the ratio 5:4. How many text messages does Layla receive? **2**

Question 12 (2 marks)

The network diagram below shows the possible paths (in km) for laying gas pipes between five locations. **2**



What is the minimum length of pipes required to provide gas to all locations?

Question 13 (4 marks) **Marks**

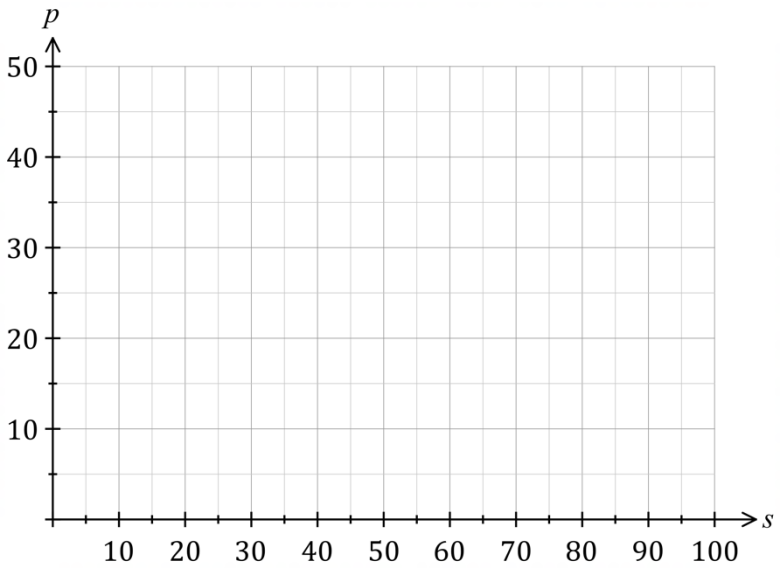
The petrol consumption (p litres per 100 km) and the speed of a car (s km/h) are modelled by the formula:

$p = 0.01s^2 - s + 33$

(a) Complete the following table of values. **1**

s	0	20	40	50	60	80	100
p							

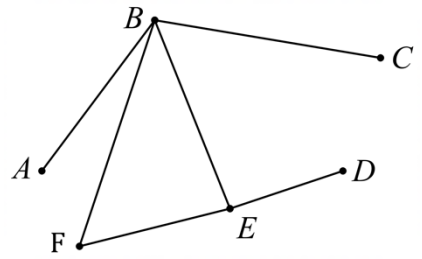
(b) Draw the graph of $p = 0.01s^2 - s + 33$ using the number plane below. **1**



(c) A car was driven at 30 km/h for 40 km. How many litres of petrol did it use? **1**

(d) Why is the formula $p = 0.01s^2 - s + 33$ not a good model if $s = 0$? **1**

Question 14 (2 marks) **Marks**



(a) Complete the table of vertex degrees for the network diagram. **1**

Vertex	*A*	*B*	*C*	*D*	*E*	*F*
Degree						

(b) Is there a path in the network that visits every edge exactly once? Give a reason for your answer. **1**

Question 15 (3 marks)

Mitchell purchased a used car for \$16 000. It depreciated by 20% per annum and is expected to be used for 10 years.

(a) What is the salvage value of the car after two years? **1**

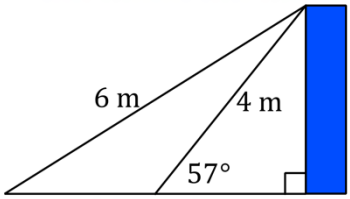
(b) How many years will it take for the salvage value of the car be less than \$4 000? Answer to the nearest whole year. **2**

Question 16 (1 mark)

The volume of petrol in a tank decreases from 28 L by 2 L every second. What is the volume of petrol in the tank after 3 seconds? **1**

Question 17 (4 marks) **Marks**

Two ladders are the same distance up the wall. The shorter ladder is 4 m long and makes an angle of 57˚ with the ground. The longer ladder is 6 m long.



Not to scale

(a) Find the distance the ladders are up the wall. Answer correct to two decimal places. **2**

(b) Find the angle the longer ladder makes with the ground. Answer correct to the nearest degree. **2**

Question 18 (4 marks)

Edward borrows $220 000 over 7 years at an interest rate of 9.5% p.a. reducible. He pays $1910 per fortnight.

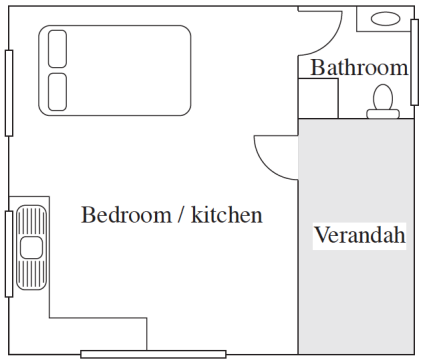
(a) How much will Edward pay back altogether? **1**

(b) What is the interest paid for this loan? **1**

(c) What is the equivalent flat interest rate charged per annum on this loan? Answer correct to 1 decimal place. **2**

Question 19 (3 marks) **Marks**

A building plan for an extension is shown below. It uses a scale of 1:100.



(a) What is the symbol used for the door? **1**

(b) What are the dimensions of the verandah? **1**
Answer correct to one decimal place.

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(c) Calculate the area of the extension. **1**
Answer correct to the nearest square metre.

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Question 20 (3 marks)

Audrey owns a credit card that has no annual fee and charges 16.3% p.a. interest on all purchases. The interest is charged on the date of purchase and the date of payment.

(a) Show that the daily interest rate is 0.04466%. **1**

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(b) On the 27th of January, Audrey bought a TV for $1029 using her credit card. Audrey paid her credit card account on the 7th of February. What was the total amount she paid for the TV, including interest? Answer correct to the nearest cent. **2**

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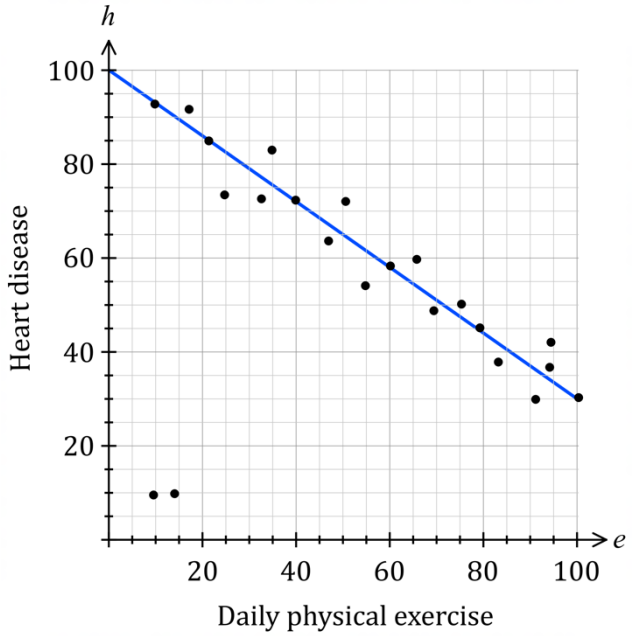
Question 21 (2 marks) **Marks**

The scatterplot shows daily physical exercise (e) versus heart disease (h).



(a) Calculate the gradient of the line. **1**

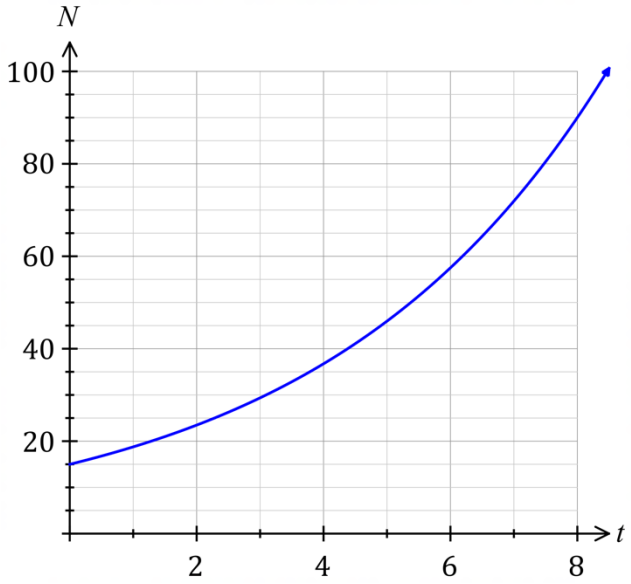
(b) What is the equation of the line of best fit drawn? **1**

Question 22 (2 marks)

A plane is flying at a speed of 900 km/h. **2**
How far will the plane travel from 10.15 am to 12.30 pm on the same day?

Question 23 (3 marks) **Marks**

The graph below shows the exponential increase in bacteria where N is the number of bacteria in thousands after t hours.



(a) What is the initial number of bacteria? **1**

(b) Estimate the time taken for the number of bacteria to reach 45 000. **1**

(c) Estimate the time taken for the number of bacteria to double its initial size. **1**

Question 24 (2 marks)

Lucas bought a new car at the beginning of 2017 for $30,000. At the end of 2017 the value of the car had depreciated by 30%. In 2018 the value of the car depreciated by 25% of the value it had at the end of 2017. What was the value of the car at the end of 2018? **2**

Question 25 (3 marks) **Marks**

Items with a different mass (m in kg) are attached to a spring. The length of the spring (L in cm) is measured for each item. The results are shown below.

m	2	5	8	11	14	17
L	41.2	55.0	68.8	82.6	96.4	110.2

(a) A linear model in the form $L = km + 32$ describes this situation. What is the value of k? **1**

(b) What is the length of the spring when no item is attached? **1**

(c) Calculate the mass of an item that will make the spring 78 cm long? **1**

Question 26 (2 marks)

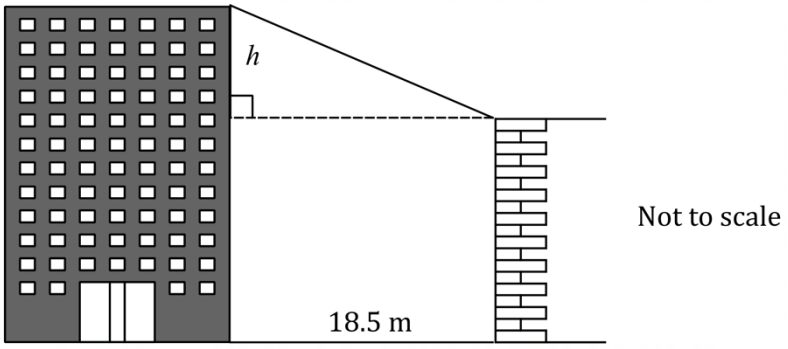
2

	W	X	Y	Z
W	–	3	9	8
X	3	–	6	1
Y	9	6	–	2
Z	8	1	2	–

Represent the table shown above as a weighted network.

Question 27 (2 marks) **Marks**

The two buildings below are standing on level ground. The horizontal distance between the buildings is 18.5 metres and the angle of elevation between the buildings is 32˚. **2**



What the difference in height (*h)* between the buildings? Answer correct to one decimal place.

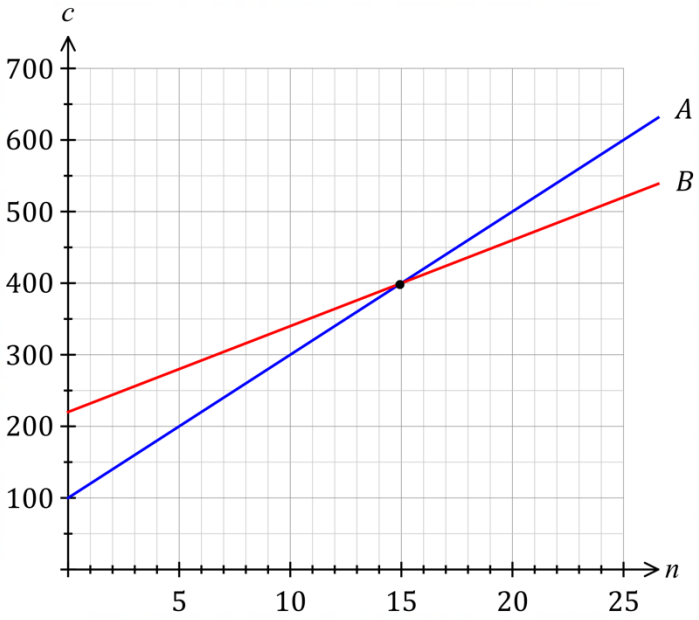
Question 28 (4 marks)

(a) Mia has a debit of $12,590 on a credit card with a simple interest rate of 18% p.a. How much interest would she pay on this debit for two years? **2**

(b) Mia transferred the debit to a new card with a simple interest rate of 21% p.a. The new card has a 0% balance transfer for 6 months. How much is saved after two years? **2**

Question 29 (4 marks) **Marks**

The graph shows the cost charged by two different businesses to cater for a party. In each case the total cost ($\$c$) depends on the number of people attending (n).



(a) For what number of people attending do the two businesses charge the same amount? **1**

(b) If ten people attend the party, what business would you recommend? Justify you answer. **1**

(c) If 25 people are to attend the party, what is the difference in the cost per person between the two businesses? **2**

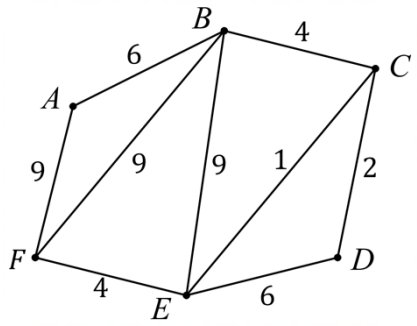
Question 30 (2 marks)

A scatterplot showing the profit made by a worker for different amounts of output. A line of best fit is drawn and its equation found to be $P = 0.5n + 4.5$, where P is the profit in dollars and n is the number of units produced. How much profit does the equation give for a worker producing one hundred million units? Do you think this an accurate prediction. Explain. **2**

Question 31 (2 marks) **Marks**

Fertiliser was added to a garden at a rate of 100 g/m^2. The fertiliser consists of nitrogen, phosphorus and potassium in the ratio of 7 : 6 : 12. How many grams of each element is that per square metre? **2**

Question 32 (4 marks)



(a) Find the length of the shortest path from A to E. **2**

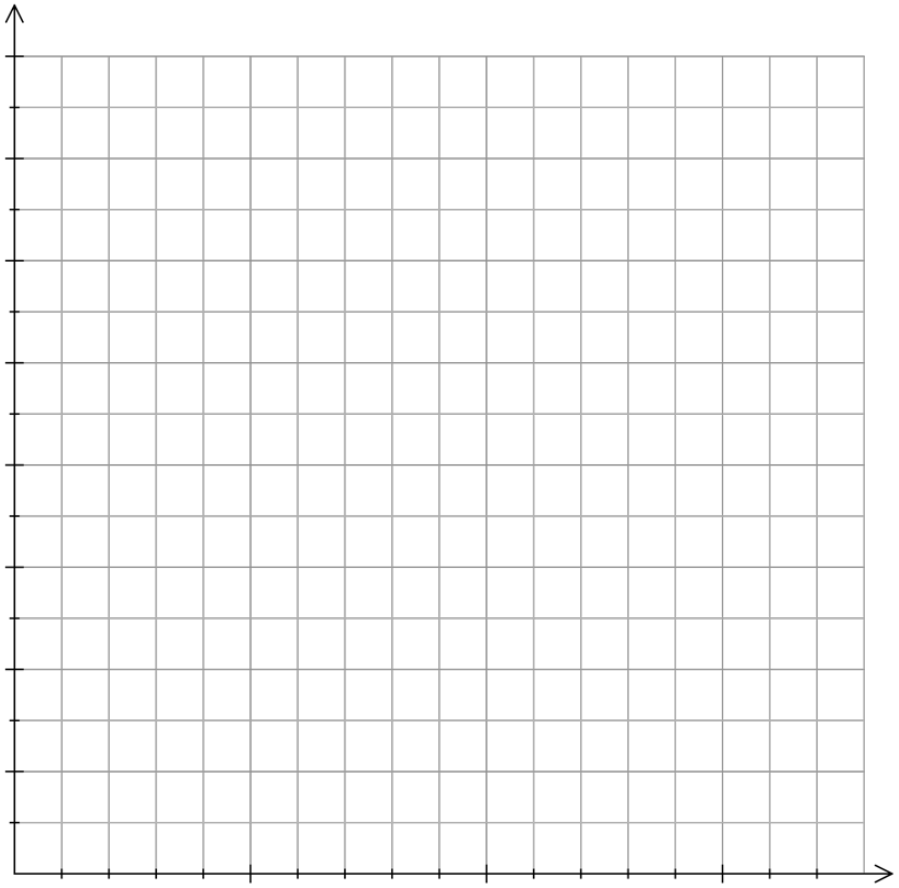
(b) Find a walk that visits every edge of the network only once, starting at C. **2**

Question 33 (4 marks) **Marks**

The table below compares age (in years) and pulse rate (in beats per minute).

a	5	10	15	20	25	30
p	60	65	65	70	70	75

(a) Draw a scatterplot using this data. **2**

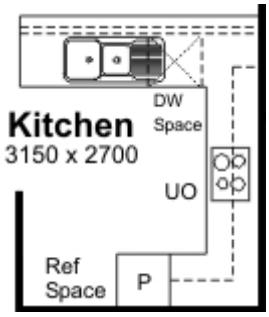


(b) Draw a line of best fit on the scatterplot. **1**

(c) Use the line of best fit to estimate the pulse rate when a person's age is 28 years. **1**

Question 34 (2 marks) **Marks**

A section of a building plan is shown below.



(a) What does 'DW' represent in this plan? **1**

(b) What are dimensions of the kitchen? **1**

Question 35 (2 marks)

A house was bought for \$940 000 and appreciated at the rate of 6% p.a. What will be the value of the house after 5 years? (Answer to the nearest dollar). **2**

Question 36 (2 marks)

Ava, Bella and Claire share a lottery prize in the ratio 2:3:4. If Claire's share is \$6480, what is Bella's share? **2**

End of paper

NSW Education Standards Authority

HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics Standard 1
Mathematics Standard 2

REFERENCE SHEET

Measurement

Precision

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

Upper bound = measurement + absolute error

Lower bound = measurement – absolute error

Length, area, surface area and volume

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

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

$$A = \frac{h}{2}\left(x + y\right)$$

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

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

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

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

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

Trigonometry

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

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

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

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

Financial Mathematics

$$FV = PV\left(1 + r\right)^n$$

Straight-line method of depreciation

$$S = V_0 - Dn$$

Declining-balance method of depreciation

$$S = V_0\left(1 - r\right)^n$$

Statistical Analysis

$$z = \frac{x - \bar{x}}{s}$$

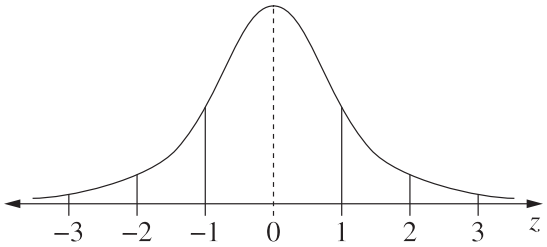
An outlier is a score

less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

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