



Student Name:

General Mathematics

2018 HSC

Assessment Task 2

General Instructions

- Reading time – 5 minutes
- Working time - 90 minutes
- Write using blue or black pen
- Calculators may be used
- A multiple-choice answer sheet is provided at the back of this paper
- A formula sheet is provided

Total Marks - 60

Section I

12 marks

- Attempt Questions 1 – 12
- Allow about 20 minutes for this section

Section II

48 marks

- Attempt Questions 13- 16
- Allow about 70 minutes for this section

Section I

Total marks (12)

Attempt Questions 1 – 12

Allow about 20 minutes for this section

Use the Multiple-Choice Answer sheet provided

1. On a map, the scale is given by 1 cm = 25 km. The distance between Terrigal and Narooma is 494 km.

How far apart are they on a map?

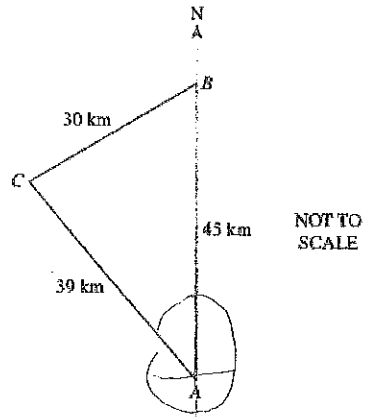
- (A) 4.94 cm
- (B) 12.35 cm
- (C) 19.76 cm
- (D) 123.5 cm

2. A clothes dryer is used once a day by a family and it uses 3.73 kWh per load.

If energy is charged at \$0.21/kWh, how much does it cost to run the dryer in May?
(Note: there are 31 days in May)

- (A) \$0.78
- (B) \$23.50
- (C) \$24.28
- (D) \$78.33

3. Town B is 45 km due north of town A and 30 km from town C. Town A is 39 km from town C.



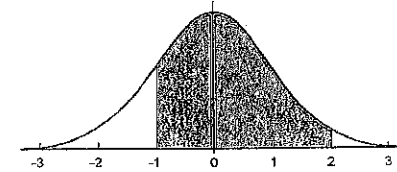
What is the bearing of town C from town A?

- (A) 041°
 (B) 139°
 (C) 319°
 (D) 301°
4. Shanghai, China has co-ordinates $(31^\circ\text{N}, 121^\circ\text{E})$. Juan travels 36° south and 12° west of Shanghai. Find his new co-ordinates.
- (A) $(5^\circ\text{S}, 109^\circ\text{E})$
 (B) $(5^\circ\text{S}, 133^\circ\text{E})$
 (C) $(67^\circ\text{N}, 109^\circ\text{E})$
 (D) $(67^\circ\text{N}, 133^\circ\text{E})$

5. How much energy does a 18 W fluorescent lamp use if it is on for 6 hours per day for 1 year?

- (A) 6.57 kWh
 (B) 10.80 kWh
 (C) 39.42 kWh
 (D) 584.0 kWh

6. The data below is normally distributed with z-scores indicated on the x-axis. What percentage of scores (correct to the nearest whole number) are shaded?

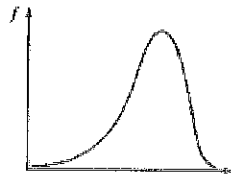


- (A) 95%
 (B) 82%
 (C) 75%
 (D) 68%
7. An electric kettle is rated at 1800W and takes two and a half minutes to boil a litre and a half of water when full. Hannah boils a full kettle of water on average four times a day. The cost of electricity on the plan that Hannah has signed up for is 12.5cents/kWh. What is the cost of using the kettle for a year (to the nearest 50 cents)?
- (A) \$3.40
 (B) \$5.50
 (C) \$13.50
 (D) \$20.50

8. A flight leaves Sydney on Wednesday at 10:25pm bound for Los Angeles. If the flight takes 14 hours, what is the day and time in Los Angeles when it arrives, given that Sydney is 17 hours ahead of Los Angeles?

- (A) Wednesday 5:25am
- (B) Thursday 5:25am
- (C) Wednesday 7:25pm
- (D) Thursday 12:25am

9.



The graph shown is:

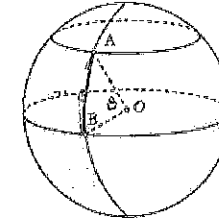
- (A) symmetrical
- (B) negatively skewed
- (C) positively skewed
- (D) bimodal

10. The mean weight of a team of 13 football players is 92 kg. During the game, an injured player weighing 110 kg is replaced with a player who weighs 102 kg.

What is the mean weight of the new team, correct to one decimal place?

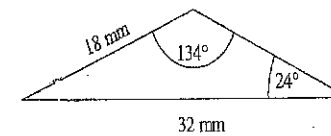
- (A) 84.0 kg
- (B) 85.3 kg
- (C) 91.4 kg
- (D) 102.6 kg

11. The shortest great circle distance between two cities, A and B, is 4120 km. To the nearest degree, what angle is made at the centre of the earth by these two cities? Assume the radius of the earth to be 6400 km.



- (A) 36°
- (B) 45°
- (C) 37°
- (D) 315°

12. The area of the figure below is closest to:



- (A) 108 mm^2
- (B) 173 mm^2
- (C) 223 mm^2
- (D) 288 mm^2

Section II

Total marks (38)

Attempt Questions 15 – 17

Allow about 55 minutes for this section

Answer in the space provided

Question 13 (12 marks)

(a) The following cumulative frequency table shows the results of a test out of 25.

Score (x)	Frequency (f)	Cumulative frequency
17	3	3
18	6	9
19	7	16
20	2	18
21	2	20
22	9	29
23	3	32

(i) What is the median?

.....

(ii) Find the mean correct to 1 decimal place.

1

(iii) Find the population standard deviation. Give your answer correct to two decimal places.

1

.....

(b) Michael surveyed 200 people about whether they liked the movies Justice League and Star Wars VIII.

	Like Justice League	Dislike Justice League	Total
Like Star Wars VIII	70		A
Dislike Star Wars VIII	50	50	
Total		80	200

(i) What value should go in the cell marked A?

1

.....

(ii) What fraction of all people surveyed disliked Justice League and also disliked Star Wars VIII?

1

.....

(iii) What percentage of people who liked Justice League, disliked Star Wars VIII?

2

.....

(c) A factory produces small metal rods designed to have a mass of 50 g. Samples were taken from two different machines and a stem-and-leaf plot was drawn.

Machine A	Machine B
	4 4
	4 8 9
3 2 2 1 1 0 0 0	5 0 0 0 0 0 1 1 1 2 3 3 3 4 4
8 8 7 6 6 5	5 5 6 7 7 8 9
0	6 1 2 3
	6 5

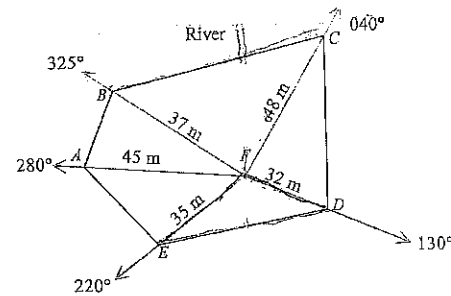
(i) Find the modal mass for each machine. 1

(ii) Calculate a five-number summary for the data set of machine A. 2

(iii) Is the sample weight of 60, in the data displayed for machine A, an outlier? Justify your answer? 2

Question 14 (12 marks)

(a) Stephanie has just purchased a vacant field, which backs onto a river along the side BC . The following diagram represents a compass radial survey of the vacant field.



(i) Show that $\angle BFC = 75^\circ$. 1

(ii) Find the length of BC , correct to 2 decimal places. 2

(iii) Find the area of $\triangle DEF$. 2

(b) A building plan has a scale of 1:100.

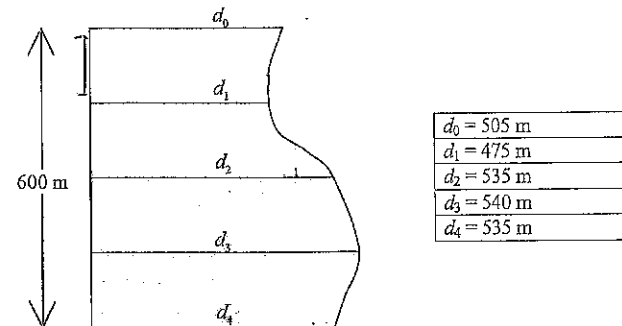
(i) The building is rectangular and, on the plan it is 18.2 cm long and 12.5 cm wide.

What is the length and width in metres, of the actual building? 1

(ii) The roof of the building is flat and collects rain for a cylindrical tank. If 25 mm of rain falls, how much will flow into the tank in litres? 2

(iii) The tank has a radius of 1.2 m and a height of 3.4 m. How many times could 25 mm of rain fall on the roof without the tank overflowing? 2

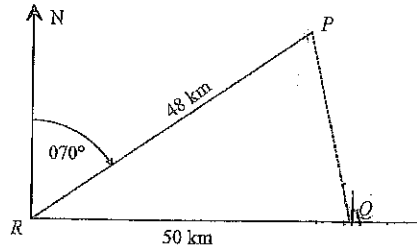
(c) Below is a plan of a paddock to be sown with wheat.



(i) Find the approximate area in hectares of the paddock using Simpson's Rule twice. Leave your answer correct to 2 decimal place. 2

Question 15 (12 marks)

- (a) The diagram shows a town Q which is 50 km due east of town R . The town P is 48 km from R on a bearing of 070° .



- (i) Show by calculations that the distance PQ is 17 km, to the nearest km. 2

- (ii) What is the bearing of P from Q ? 2

- (b) A ship sails due South from Port A ($42^\circ N, 67^\circ W$) to Port B ($11^\circ N, 67^\circ W$).

How far does the ship sail to the nearest kilometre? Assume the radius of the Earth is 6400 km. 2

- (c) When it is noon Thursday, local time, in Chicago ($42^\circ N, 88^\circ W$), what is the local time in Tokyo ($36^\circ N, 140^\circ E$). 2

- (d) Jack is planning to sail between two islands. The islands have a bearing of $(0^\circ, 176^\circ W)$ and $(0^\circ, 166^\circ E)$.

Assuming the radius of the Earth is 6400 km, calculate the shortest distance between the two islands. Leave your answer correct to the nearest kilometer. /2

- (e) Sarah flew from Moscow ($55^\circ N, 28^\circ E$) to Sydney ($34^\circ S, 151^\circ E$). Her plane left Moscow at 4pm Monday (Moscow time). She had a 12 hour stopover in Singapore to shop and arrived in Sydney at 10 am on Wednesday (Sydney time).

What was the total flying time?

2

Question 16 (12 marks)

- (a) Tom has received his results for his two favourite subjects. Below is a summary:

Subject	Tom's mark	Course average	Course standard deviation
Mathematics	72%	68%	8
Industrial Technology	82%	79%	5

- (i) What is Tom's z-score for each subject?

2

- (ii) Using your calculations in (i), in which subject did Tom perform better? Explain why he did better in that particular subject. /1

1

- (iii) What percentage of students in Tom's course scored a mark between 74 and 89 in Industrial Technology?

2

(b) The marks on a history examination were normally distributed. Wally, a student who sat the exam, converted his mark to a z-score and got a value of 1.

If 25 people sat the examination, how many students had marks which were equal to or below Wally's mark?

1

(c) Packets of rice are labelled as weighing 500 g. When the weights were checked, they were found to be normally distributed with a mean of 500 g and a standard deviation of 2 g.

(i) What percentage of packets weighed less than the labelled weight? 1

(ii) If 1000 packets were checked, how many would be expected to weigh between 496 g and 502 g? 2

(iii) The z - score for one packet was found to be -2.5 . Find the weight of this packet of rice. 1

(d) A team of construction workers have a mean number of sick days of 6 per year with a standard deviation of 1.2.

What would be the new mean and standard deviation if each person had an extra 2 days sick next year?

2

.....

.....

.....

.....

.....

End of Exam



Student Name: Southern

General Mathematics

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Total Marks - 60

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12 marks

- Attempt Questions 1 – 12
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Section II

48 marks

- Attempt Questions 13- 16
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Section I

Total marks (12)

Attempt Questions 1 – 12

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Use the Multiple-Choice Answer sheet provided

1. On a map, the scale is given by 1 cm = 25 km. The distance between Terrigal and Narooma is 494 km.

How far apart are they on a map?

$$\frac{494}{25} = 19.76 \text{ cm}$$

- (A) 4.94 cm
- (B) 12.35 cm
- (C) 19.76 cm
- (D) 123.5 cm

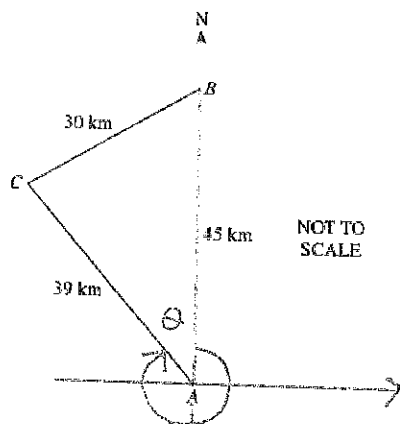
2. A clothes dryer is used once a day by a family and it uses 3.73 kWh per load. If energy is charged at \$0.21/kWh, how much does it cost to run the dryer in May?

- (A) \$0.78
- (B) \$23.50
- (C) \$24.28
- (D) \$78.33

$$= 31 \times 3.73 \times 0.21$$

$$= \$24.2823 \dots$$

3. Town B is 45 km due north of town A and 30 km from town C. Town A is 39 km from town C.



What is the bearing of town C from town A?

- (A) 041°
- (B) 139°
- (C) 319°
- (D) 301°

$$\cos \theta = \frac{39^2 + 45^2 - 30^2}{2 \cdot 39 \cdot 45}$$

$$\theta = 41^{\circ} 4' 31.26''$$

$$\therefore \text{Bearing} = 360 - 41 = 319^{\circ}$$

4. Shanghai, China has co-ordinates (31°N, 121°E). Juan travels 36° south and 12° west of Shanghai. Find his new co-ordinates.

- (A) (5° S, 109° E)
- (B) (5° S, 133° E)
- (C) (67° N, 109° E)
- (D) (67° N, 133° E)

- (b) Michael surveyed 200 people about whether they liked the movies Justice League and Star Wars VIII.

	Like Justice League	Dislike Justice League	Total
Like Star Wars VIII	70	30	A
Dislike Star Wars VIII	50	50	100
Total	120	80	200

- (i) What value should go in the cell marked A? 1

$$A = 100$$

- (ii) What fraction of all people surveyed disliked Justice League and also disliked Star Wars VIII? 1

$$\frac{50}{200} = \frac{1}{4}$$

- (iii) What percentage of people who liked Justice League, disliked Star Wars VIII? 2

$$\frac{50}{120} \times 100 = 41.6\% = 41\frac{2}{3}\%$$

... produces small metal rods designed to have a mass of 50 g. Samples were taken from 2 different machines and a stem-and-leaf plot was drawn.

Machine A	Machine B
9 9 9 9 9	4 4
1 0 0 0	4 8 9
8 8 7 6 6 5	5 0 0 0 0 0 1 1 1 2 3 3 3 4 4
0	5 5 6 7 7 8 9
	6 1 2 3
	6 5

(i) Find the modal mass for each machine. 1

Mach. A = 49
Mach. B = 50

(ii) Calculate a five-number summary for the data set of machine A. 2

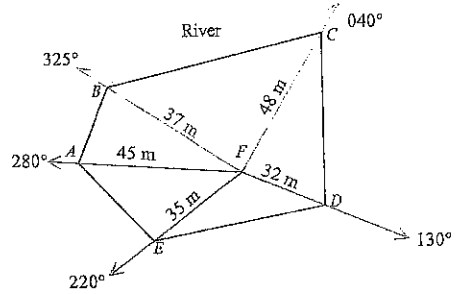
Machine A
lowest score = 49
Q₁ (lower quartile) = 49.5
Q₂ (median) = 51.5
Q₃ (upper quartile) = 56
highest score = 60

(i) Is the sample weight of 60 in the data displayed for machine A an outlier? Justify your answer? 2

$Q_3 + 1.5 \times IQR$
 $= 56 + (1.5 \times 6.5)$
 $= 65.75$
Note
 $IQR = 56 - 49.5 = 6.5$
60 is not an outlier
It is below 65.75

Question 14 (12 marks)

(a) Stephanie has just purchased a vacant field, which backs onto a river along the side BC. The following diagram represents a compass radial survey of the vacant field.



(i) Show that $\angle BFC = 75^\circ$. 1

$$\angle BFC = (360 - 325) + 40$$

$$= 35 + 40$$

$$= 75^\circ$$

(ii) Find the length of BC, correct to 2 decimal places. 2

$$BC^2 = 37^2 + 48^2 - 2 \times 37 \times 48 \times \cos 75^\circ$$

$$BC = 52.4754 \dots$$

$$BC = 52.48 \text{ m}$$

(iii) Find the area of $\triangle DEF$. 2

$$A = \frac{1}{2} \times 35 \times 32 \times \sin 90^\circ$$

$$= 560 \text{ m}^2$$

(b) A building plan has a scale of 1:100.

(i) The building is rectangular and, on the plan it is 18.2 cm long and 12.5 cm wide.

What is the length and width, in metres, of the actual building? 1

length = $18.2 \times 100 = 1820 \text{ cm}$
width = $12.5 \times 100 = 1250 \text{ cm}$
length = 18.2 m width = 12.5 m

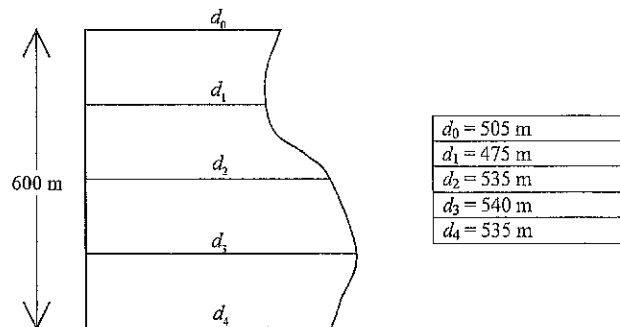
(ii) The roof of the building is flat and collects rain for a cylindrical tank. If 25 mm of rain falls, how much will flow into the tank in litres? 2

$V = 18.2 \times 12.5 \times 0.025 = 5.6875 \text{ m}^3$
Capacity = $5.6875 \times 1000 = 5687.5 \text{ L}$

(iii) The tank has a radius of 1.2 m and a height of 3.4 m. How many times could 25 mm of rain fall on the roof without the tank overflowing? 2

$V = \pi \times 1.2^2 \times 3.4 = 15.3812 \text{ m}^3$
Capacity of tank = $15.3812 \times 1000 = 15381.23763 \text{ L}$
 $\frac{15381.23763}{5687.5} = 2.709 \dots$
ie 25 mm of rain can fall twice!

(c) Below is a plan of a paddock to be sown with wheat.

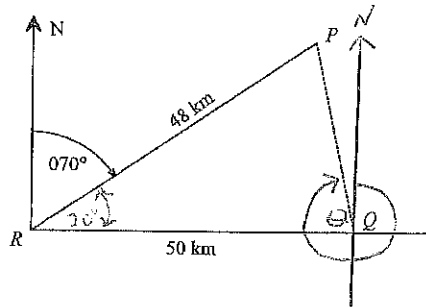


(i) Find the approximate area in hectares of the paddock using Simpson's Rule twice. Leave your answer correct to 2 decimal place. 2

$A = \frac{150}{3} (505 + (4 \times 475) + 535) + \frac{150}{3} (535 + (4 \times 540) + 535)$
 $= 147000 + 161500$
 $= 308500 \text{ m}^2$
 $= (308500 \div 10000) \text{ ha}$
 $= 30.85 \text{ ha}$

Question 15 (12 marks)

- (a) The diagram shows a town Q which is 50 km due east of town R . The town P is 48 km from R on a bearing of 070° .



- (i) Show by calculations that the distance PQ is 17 km, to the nearest km. 2

$$PQ^2 = 48^2 + 50^2 - 2 \times 48 \times 50 \times \cos 20$$

$$= 17.1311 \dots \text{ km}$$

$$PQ = 17 \text{ km}$$

- (ii) What is the bearing of P from Q ? 2

$$\frac{\sin \alpha}{48} = \frac{\sin 20}{17}$$

$$\sin \alpha = \frac{48 \sin 20}{17}$$

$$\alpha = 74^\circ 57' 3.45''$$

$$\text{bearing} = 270^\circ + 75^\circ$$

$$= \underline{\underline{345^\circ}}$$

- (b) A ship sails due South from Port A ($42^\circ N, 67^\circ W$) to Port B ($11^\circ N, 67^\circ W$).

How far does the ship sail to the nearest kilometre? Assume the radius of the Earth is 6400 km. 2

$$\text{distance} = \frac{42-11}{360} \times 2 \times \pi \times 6400$$

$$= \frac{31}{360} \times 2 \times \pi \times 6400$$

$$= 3462.7332$$

$$= 3463 \text{ km}$$

- (c) When it is noon Thursday, local time, in Chicago ($42^\circ N, 88^\circ W$), what is the local time in Tokyo ($36^\circ N, 140^\circ E$). 2

$$\frac{88+140}{15} = 15.2 \text{ hrs} \rightarrow 15 \text{ hrs } 12 \text{ min}$$

$$C \leftarrow \text{---} \text{---} \text{---} \rightarrow T$$

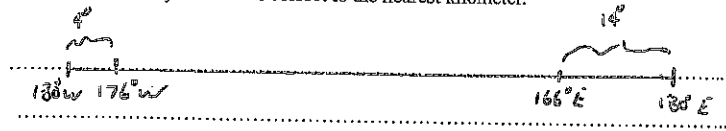
$$88^\circ W \quad 0 \quad 140^\circ E$$

Thurs. noon add 15 hrs 12 min Fri. 3:12 am

Friday 3:12 am in Tokyo

- (d) Jack is planning to sail between two islands. The islands have a bearing of $(0^\circ, 176^\circ W)$ and $(0^\circ, 166^\circ E)$.

Assuming the radius of the Earth is 6400 km, calculate the shortest distance between the two islands. Leave your answer correct to the nearest kilometer. 2



$$\begin{aligned} \text{Shortest distance} &= \frac{14}{360} \times 2 \times \pi \times 6400 \\ &= 2010.6192 \dots \\ &= 2011 \text{ km} \end{aligned}$$

- (e) Sarah flew from Moscow $(55^\circ N, 28^\circ E)$ to Sydney $(34^\circ S, 151^\circ E)$. Her plane left Moscow at 4pm Monday (Moscow time). She had a 12 hour stopover in Singapore to shop and arrived in Sydney at 10 am on Wednesday (Sydney time).

What was the total flying time? 2



$$\frac{151 - 28}{15} = 8.2 \text{ hrs}$$

$$= 8 \text{ h } 12 \text{ min}$$

Mon 4pm

↓ 12 hr stop

Tues 9am

→ plus 8h 12min

Tues 11.12pm

↓ 21 hr 48 min

Wed 10am

$$\text{Flying time} = 21 \text{ hours } 48 \text{ min}$$

Question 16 (12 marks)

- (a) Tom has received his results for his two favourite subjects. Below is a summary:

Subject	Tom's mark	Course average	Course standard deviation
Mathematics	72%	68%	8
Industrial Technology	82%	79%	5

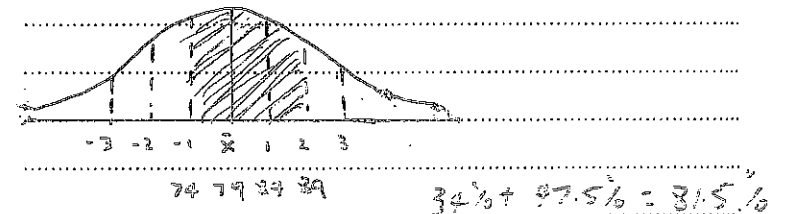
- (i) What is Tom's z-score for each subject? 2

Maths	Ind. Tech.
$\frac{72 - 68}{8}$	$\frac{82 - 79}{5}$
$z = 0.5$	$z = 0.6$

- (ii) Using your calculations in (i), in which subject did Tom perform better? Explain why he did better in that particular subject. 1

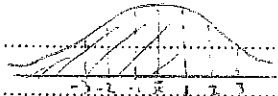
Tom performed better in Industrial Technology because he had a greater z-score.

- (iii) What percentage of students in Tom's course scored a mark between 74 and 89 in Industrial Technology? 2



(b) The marks on a history examination were normally distributed. Wally, a student who sat the exam, converted his mark to a z-score and got a value of 1.

If 25 people sat the examination, how many students had marks which were equal to or below Wally's mark?



$$84\% \text{ of } 25 = 0.84 \times 25$$

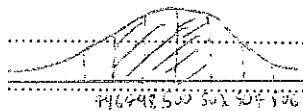
$$= 21 \text{ students}$$

(c) Packets of rice are labelled as weighing 500 g. When the weights were checked, they were found to be normally distributed with a mean of 500 g and a standard deviation of 2 g.

(i) What percentage of packets weighed less than the labelled weight? 1

$$50\%$$

(ii) If 1000 packets were checked, how many would be expected to weigh between 496 g and 502 g? 2



$$68\% + 13.5\% = 81.5\%$$

$$\therefore 0.815 \times 1000$$

$$= 815 \text{ packets}$$

(iii) The z-score for one packet was found to be -2.5. Find the weight of this packet of rice. 1

$$-2.5 = \frac{x - 500}{2}$$

$$-5 = x - 500$$

$$x = 495 \text{ g}$$

(d) A team of construction workers have a mean number of sick days of 6 per year with a standard deviation of 1.2.

What would be the new mean and standard deviation if each person had an extra 2 days sick next year?

2

$$\text{new mean} = 8$$

$$\text{new stand. deviation} = 1.2 \text{ (stays the same)}$$

End of Exam