2021 YEAR 9 (5.1) MATHEMATICS
Written examination

Reading time: 15 minutes
Writing time: 3 hours

2021 version 1

QUESTION BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	10	10	50
C	3	3	30
			Total 100

SECTION A

Instructions for Section A

Answer **all** questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

$\frac{4}{3} \div 2\frac{1}{3}$ simplifies to

A. $\frac{4}{7}$

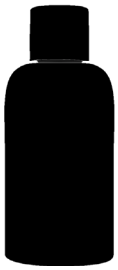
B. $\frac{7}{4}$

C. $\frac{28}{3}$

D. $\frac{3}{28}$

E. 4

Question 2



A bottle of shampoo, normally priced at $8.60, is discounted by 20%.
The discounted price of the bottle of shampoo is

A. $1.72

B. $4.30

C. $6.40

D. $6.88

E. $8.43

The following information relates to Questions 19 – 20.

A group of 90 Year 9 students were asked about what they wished to do when they left school.
The following two-way table summarises the Year 9 students' responses.

	Tertiary Education	**Work**
Girls	30	18
Boys	25	17

A Year 9 student from this group is randomly selected.

Question 19

The probability that this student is a girl or wanting to work is

A. $\frac{13}{18}$

B. $\frac{7}{18}$

C. $\frac{8}{15}$

D. $\frac{3}{8}$

E. $\frac{1}{5}$

Question 20

Which one of the following statements is **true**?

A. Randomly selecting a Year 9 student from the group is a two-step experiment

B. The most likely outcome is that the randomly selected student is a boy who wants to work

C. The total number of Year 9 students that were surveyed is 100

D. The complementary event of selecting a girl is selecting a student who wishes to work

E. It is impossible to select a Year 9 student in this group who does not wish to pursue tertiary study nor work

END OF SECTION A

SECTION B

Instructions for Section B

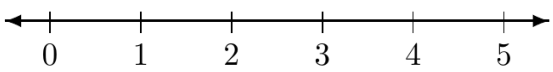
Answer **all** questions.
In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (5 marks)

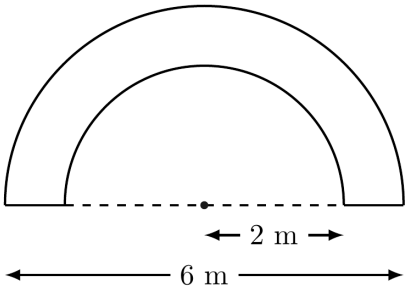
a. Evaluate 8 – 17. 1 mark

b. Write the numbers 23.5%, $\frac{11}{43}$ and 0.25 in ascending order. 2 marks

c. The number 2 is increased by 100%. 2 marks
Indicate the resulting number on the number line below.



Question 8 (5 marks)
Consider the shape shown below.



a. The area of the shape is $k\pi$ m^2, where k is a positive constant. 3 marks
Find the value of k.

b. Find the perimeter of the shape. 2 marks
Round your answer to one decimal place.

Question 10 (5 marks)
The table below shows the cost of electricity each day for a gym last week.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Cost ($)	106	96	86	84	80	79	71

a. Find the median daily cost of electricity last week. 1 mark

b. Find the mean daily cost of electricity last week. 2 marks

c. Briefly describe how the cost of electricity varied each day last week. 1 mark

d. State the name of a statistical plot appropriate for displaying the data above. 1 mark

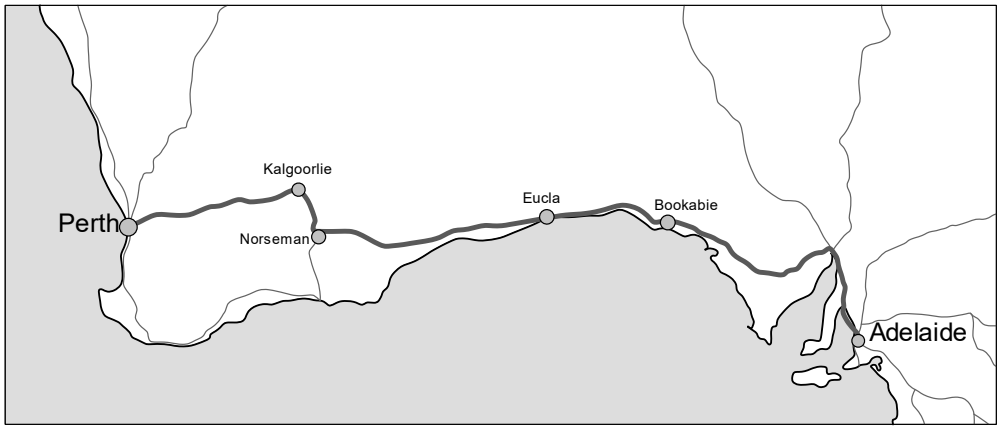
END OF SECTION B

SECTION C

Instructions for Section C

Answer **all** questions.
In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (10 marks)
The distance between Adelaide and Perth is approximately 2,696 km.



a. Find the distance between Adelaide and Perth in metres. 2 marks
Show your working.

b. Express your answer to part **a** in scientific notation. 1 mark

c. A traveller is driving from Adelaide to Perth. 2 marks
Kalgoorlie is 80.16% of the way to Perth from Adelaide.
What is the distance between Kalgoorlie and Perth?
Round your answer to the nearest kilometre.

Question 3 (10 marks)
Two pharmacies (Downtown and Midtown) both sell a particular brand of sunscreen ahead of summer. The number of bottles of sunscreen sold at these two pharmacies over a 13-day period are compared in the following back-to-back stem-and-leaf plot.

Downtown						Midtown					
				9	0	2	5	6			
		8	6	5	1	1	1	3	5	7	8
	8	7	4	4	2	3	5	5	9		
9	8	5	4	2	3						

0|2 means 2 bottles

a. What type of variable is the number of bottles sold? 1 mark

_____

b. Show that the range of bottles sold for Midtown pharmacy is 27. 1 mark

_____

_____

c. Which shop has a greater spread of the number of bottles sold? 2 marks
Support your answer with a relevant measure.

_____

_____

_____

d. On what percentage of days did Downtown pharmacy sell more than 18 bottles? 2 marks
Round your answer to one decimal place.

_____

_____

_____

SOLUTIONS

SECTION A

Question	Answer
1	A
2	D
3	C
4	E
5	D
6	C
7	B
8	C
9	A
10	D
11	E
12	D
13	B
14	C
15	B
16	A
17	B
18	D
19	A
20	E

Question 1

$$\frac{4}{3} \div 2\frac{1}{3} = \frac{4}{3} \div \frac{7}{3}$$
$$= \frac{4}{3} \times \frac{3}{7}$$
$$= \frac{4}{7}$$

Answer is **A**.

Question 2

$\$8.60 \times (1 - 0.2) = \$6.88$

Answer is **D**.

Question 3

$$\frac{\$17808}{12} = \$1484$$

Answer is **C**.

Question 4

$$I = \frac{\$660}{\$4000 \times (5.5/100)}$$
$$= 3 \text{ years}$$

Answer is **E**.

Question 5

The number 3 will make the equation valid.

Answer is **D**.

Question 6

300,000,000 m/s = 3.0×10^8 m/s

Answer is **C**.

Question 7

Using the two points (2,0) and (0,4)

$$\text{gradient} = \frac{4-0}{0-2}$$
$$= -2$$

Answer is **B**.

Question 8 (5 marks)

a. 3 marks

$\frac{1}{2}\times\pi\times3^2-\frac{1}{2}\times\pi\times2^2$ (A1)

$=\frac{9}{2}\pi-\frac{4}{2}\pi$

$=\frac{5}{2}\pi$ (A1)

Therefore, $k=\frac{5}{2}$. (A1)

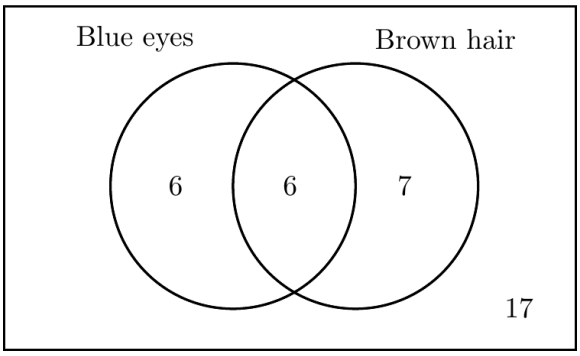
b. 2 marks

$\text{Perimeter}=\frac{1}{2}\times2\times\pi\times3+\frac{1}{2}\times2\times\pi\times2+(6-4)$ (A1)

≈17.7 m (A1)

Question 9 (5 marks)

a. 2 marks



- All of the numbers are correct. (A1)×2
- Penalise one mark per error.

b. 1 mark

$\frac{17}{36}$ (A1)

c. 2 marks

$\frac{6}{36}$ (A1)

$=\frac{1}{6}$ (A1)

2021 YEAR 9 (5.2) MATHEMATICS
Written examination

Reading time: 15 minutes
Writing time: 3 hours

2021 version 1

QUESTION BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	10	10	50
C	3	3	30
			Total 100

Question 9

The equation of a circle centred at the origin with a radius of 3 is

A. $x^2 + y^2 = 6$

B. $x^2 + y^2 = 9$

C. $x^2 + y^2 = 3$

D. $x^2 + y^2 = 1$

E. $x^2 + y^2 = 2$

Question 10

Some working for solving the equation $\frac{2m}{3} - \frac{m+1}{2} = -1$ is shown below.

Line 1: $6 \times \left(\frac{2m}{3} - \frac{m+1}{2} \right) = 6 \times (-1)$

Line 2: $4m - 3(m+1) = -6$

Line 3: $4m - 3m + 3 = -6$

Line 4: $m = -9$

Which one of the following statements is **true**?

A. The first error was made in **Line 1**

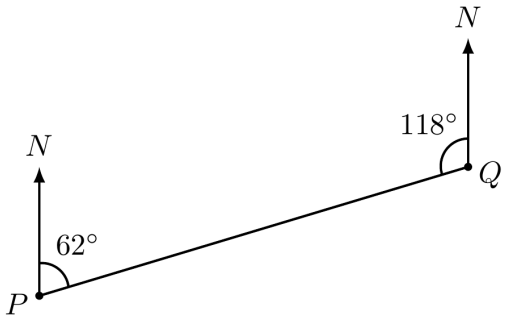
B. The first error was made in **Line 2**

C. The first error was made in **Line 3**

D. The first error was made in **Line 4**

E. There were no errors and $m = -9$ is the correct solution

Question 11



Which one of the following statements is **true** about the diagram above?

A. The bearing of P from Q is 242º

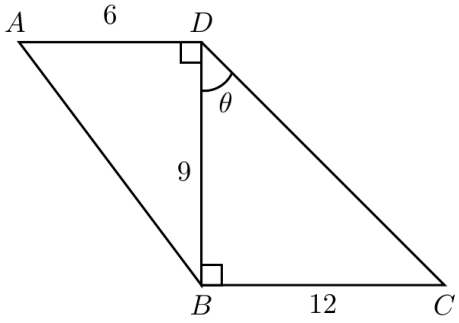
B. The bearing of P from Q is 118º

C. The bearing of P from Q is 062º

D. The bearing of Q from P is 118º

E. The bearing of Q from P is 242º

The following information relates to Questions 12 – 13.



Question 12

The value of θ is closest to

A. 33.7º

B. 36.9º

C. 41.4º

D. 41.8º

E. 53.1º

Question 13

The perimeter of the quadrilateral $ABCD$ is closest to

A. 16.8

B. 43.8

C. 81.0

D. 162

E. 360

The following information relates to Questions 19 – 20.

Two letters are randomly selected from the word SIT.

Question 19

Which of the following tables correctly represents the outcomes if the experiment is conducted **without replacement**?

A.

		1st		
		S	**I**	**T**
2nd	**S**	✕	(I,S)	(T,S)
	I	(S,I)	✕	(T,I)
	T	(S,T)	(I,T)	✕

B.

		1st		
		S	**I**	**T**
2nd	**S**	(S,S)	(I,S)	(T,S)
	I	(S,I)	(I,I)	(T,I)
	T	(S,T)	(I,T)	(T,T)

C.

		1st		
		S	**I**	**T**
2nd	**S**	✕	(S,I)	(S,T)
	I	(I,S)	✕	(I,T)
	T	(T,S)	(T,I)	✕

D.

		1st		
		S	**I**	**T**
2nd	**S**	(S,S)	(S,I)	(S,T)
	I	(I,S)	(I,I)	(I,T)
	T	(T,S)	(T,I)	(T,T)

E.

		1st		
		S	**I**	**T**
2nd	**S**	(S,S)	✕	✕
	I	✕	(I,I)	✕
	T	✕	✕	(T,T)

END OF SECTION A

SECTION B

Instructions for Section B

Answer **all** questions.
In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (5 marks)

a. Use your calculator to evaluate $\sqrt{1.69}$. 1 mark

b. Find the result of increasing \$620 by 15%. 2 marks

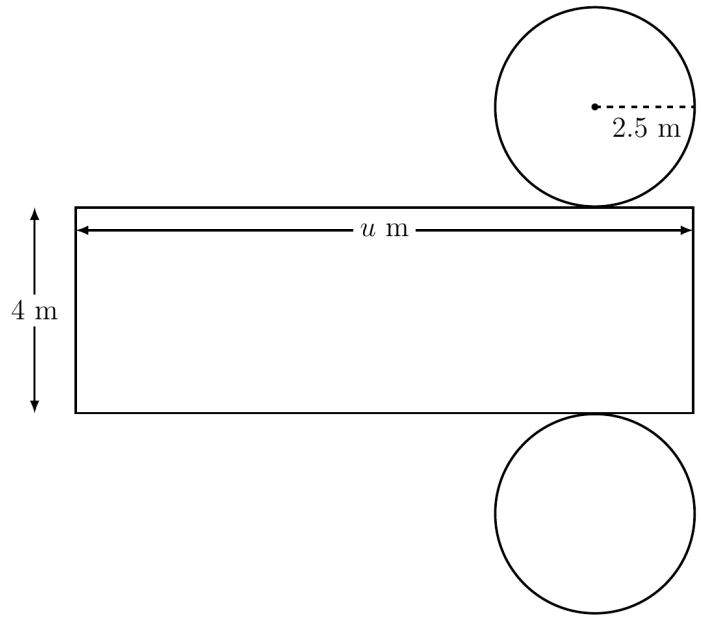
c. Write $\frac{53}{66}$ as a recurring decimal. 2 marks

Question 3 (5 marks)
There are 2^{15} users of a mobile application today.
Due to popularity, the number of users doubles every three days.

a. Write down the number of users of the mobile application 6 days from today in the form 2^n, where n is a positive integer. 2 marks

b. After how many days will there be 2^{22} users? 3 marks

Question 7 (5 marks)
A net of a cylinder is shown below.



a. Write down an expression for u in terms of π. 1 mark

b. Find the surface area of the cylinder. 2 marks
Round your answer to one decimal place.

c. Two of these cylinders are stacked on top of one another. 2 marks
Find the combined volume of the cylinders.
Round your answer to one decimal place.

SECTION C

Instructions for Section C

Answer **all** questions.
In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (10 marks)

Elly drove from a farm to the city at an average speed of $16\frac{2}{3}$ metres per second.

She drove back to the farm at an average speed of 80 kilometres per hour.

Elly's trip took 3.5 hours in total.

a. Show that $16\frac{2}{3}$ metres per second is equal to 60 kilometres per hour. 2 marks

b. Round $16\frac{2}{3}$ to two decimal places. 1 mark

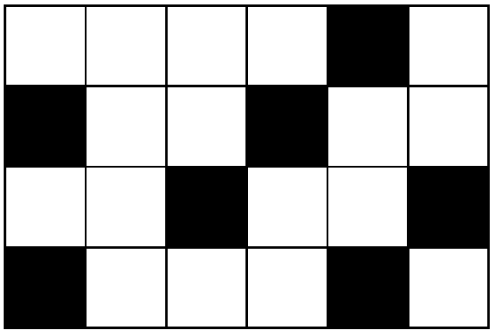
The distance between the farm and the city is d kilometres.

c. Write each of the following expressions in terms of d.

i. The time, in hours, taken by Elly to travel from the farm to the city. 1 mark

ii. The time, in hours, taken by Elly to travel from the city back to the farm. 1 mark

Question 3 (10 marks)
A grid is made up of black squares and white squares.



A square from this grid is randomly selected and its colour is noted.
This experiment is repeated 1,000 times.
The following table is incomplete as it only shows the number of black squares obtained.

Outcome	Frequency
Black	303
White	
Total	

a. Complete the table by writing down the appropriate numbers. 1 mark

b. Find the experimental probability of obtaining a black square. 2 marks
Write your answer as a decimal.

c. Is the theoretical probability of obtaining a black square close to the experimental probability? 2 marks
Justify your answer.

SOLUTIONS

SECTION A

Question	Answer
1	A
2	C
3	E
4	B
5	C
6	D
7	E
8	D
9	B
10	C
11	A
12	E
13	B
14	D
15	C
16	D
17	C
18	B
19	A
20	E

Question 1

$$\frac{2}{a} \div \frac{4}{a} = \frac{2}{a} \times \frac{a}{4}$$
$$= \frac{1}{2}$$

Answer is **A**.

Question 2

$$90 \text{ km/hr} = 90 \times \frac{1000}{3600} \text{ m/s}$$
$$= 25 \text{ m/s}$$

Answer is **C**.

Question 4 (5 marks)

a. 2 marks

$7y+80=150$ (A1)

$7y=70$

$y=10$ (A1)

b. 3 marks

$2x+3(x+5)=0$

$2x+3x+15=0$ (A1)

$5x=-15$ (A1)

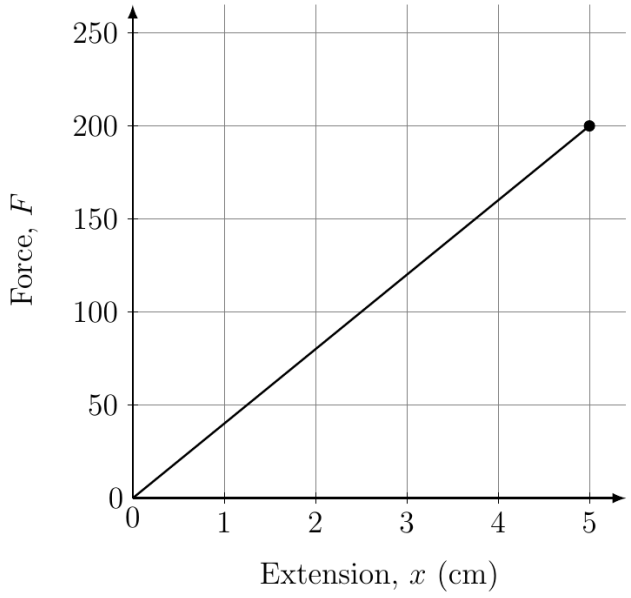
$x=-3$ (A1)

Question 5 (5 marks)

a. 1 mark

200/5 =40. Therefore, $F=40x$ (A1)

b. 2 marks



- The graph passes through the origin. (A1)
- The graph passes through the point (5,200) (A1)

c. 2 marks

$40x=250$ (A1)

$x=\frac{250}{40}$

$=6.25$ cm (A1)

2021 YEAR 9 (5.3) MATHEMATICS
Written examination

Reading time: 15 minutes
Writing time: 3 hours

2021 version 1

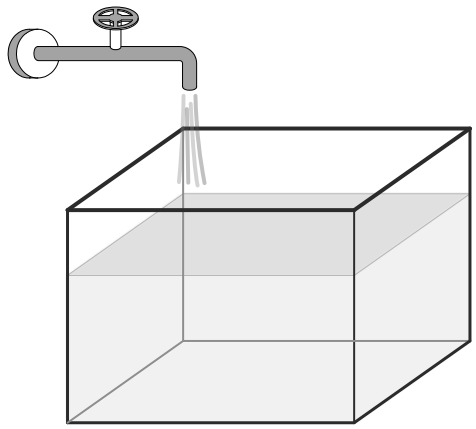
QUESTION BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	20	20	20
B	10	10	50
C	3	3	30
			Total 100

Question 4

An empty aquarium of capacity 290 L is being filled with water at a constant rate of 0.5 L per minute.



If the aquarium was full by 5:49 pm, at 5:39 pm the aquarium was filled to a capacity of

A. 5%

B. 95%

C. 98.1%

D. 98.3%

E. 99.6%

Question 5

The number of solutions to the equation $3x^3 - 6 = 75$ is

A. 1

B. 2

C. 3

D. 4

E. 5

Question 6

Making s the subject the equation $\frac{u}{s} = \frac{t}{s-2}$ results in

A. $s = \frac{2u}{u-t}$

B. $u = \frac{st}{s-2}$

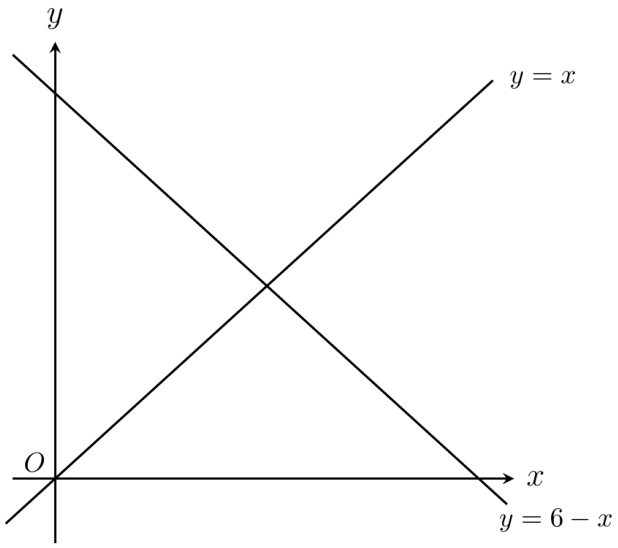
C. $s = \frac{u-t}{2u}$

D. $t = \frac{u(s-2)}{s}$

E. $s = \frac{u}{u-t}$

Question 7

Two lines are shown on the same set of axes below.



The area of the shape enclosed by the two lines and the x-axis is

A. 3 units^2

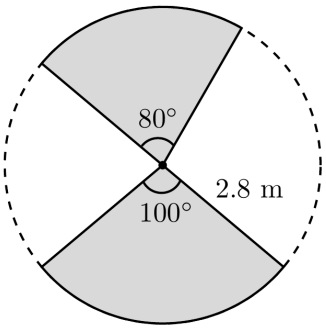
B. 4.5 units^2

C. 9 units^2

D. 10 units^2

E. 12 units^2

Question 8



The area of the shaded parts of the circle above is closest to

A. 2.2 m^2

B. 4.3 m^2

C. 8.8 m^2

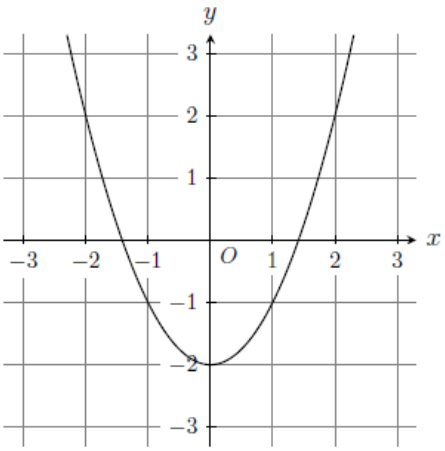
D. 12.3 m^2

E. 24.6 m^2

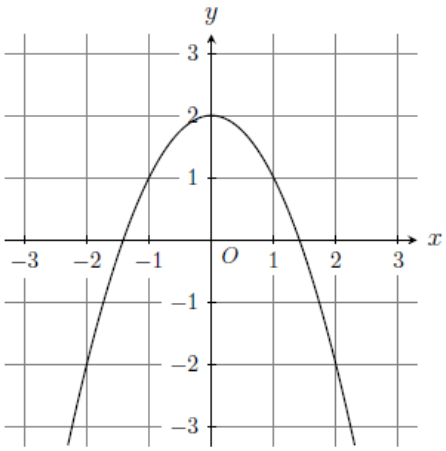
Question 9

The graph of $y = -x^2 - 1$ is best represented by

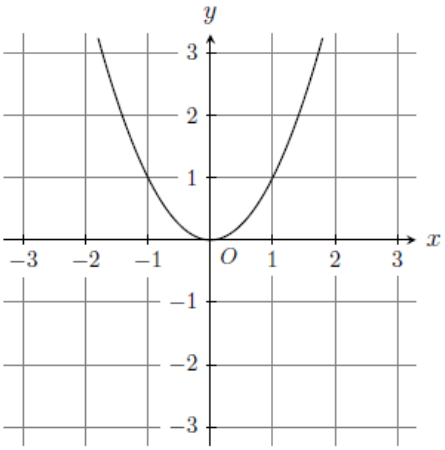
A.



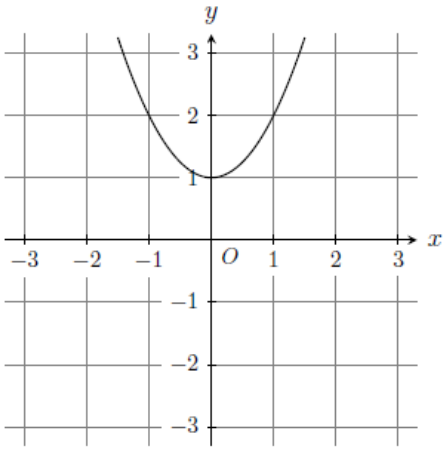
B.



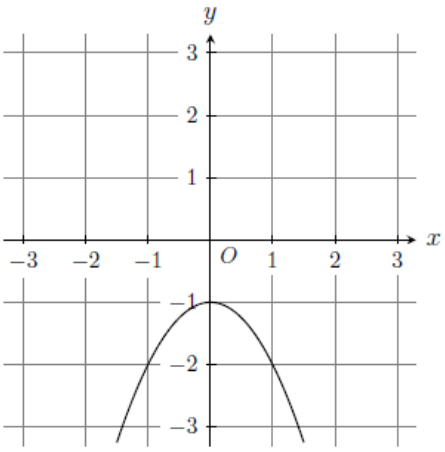
C.



D.



E.



SECTION B

Instructions for Section B

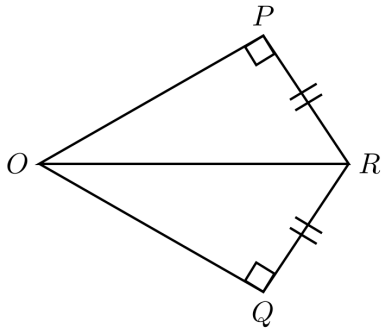
Answer **all** questions.
In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (5 marks)

a. If $ab = 1$ and $a - 3b = 6$ evaluate $\dfrac{(a-3b)^2 - 6ab}{ab}$. 2 marks

b. Show that $0.\dot{5}\dot{4} = \dfrac{6}{11}$. 3 marks

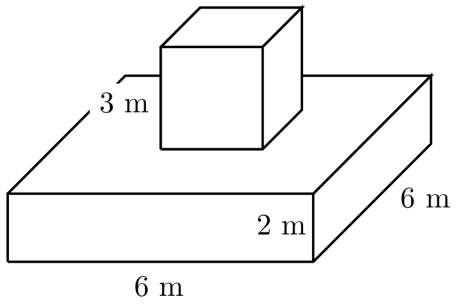
Question 4 (5 marks)
Consider the diagram shown below.



The working below is an incomplete proof that triangle *OPR* and triangle *OQR* are congruent.
Write down the appropriate numbers or symbols in the gaps.

_____ is common for both triangle *OPR* and triangle *OQR*.
It is given that _____=_____.
OPR = *OQR* = _____º
Therefore, by the _____ test, triangle *OPR* and triangle *OQR* are congruent.

Question 7 (5 marks)
A composite solid is shown below.
The smaller solid is a cube whose side length is 3 m.



a. Find the volume of the composite solid. 2 marks

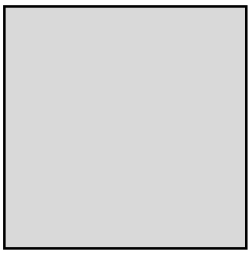
b. Find the surface area of the composite solid, including the base side. 3 marks

SECTION C

Instructions for Section C

Answer **all** questions.
In all questions where a numerical answer is required, an **exact** value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (10 marks)
Consider a square shown below.

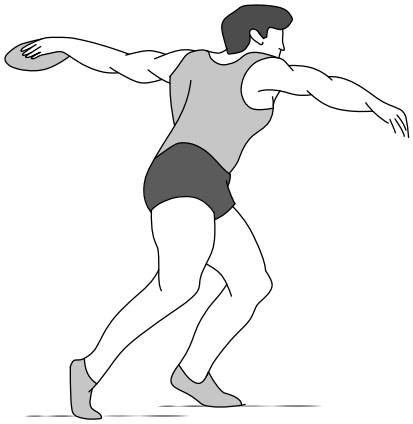


Let x cm be the side length of this square.

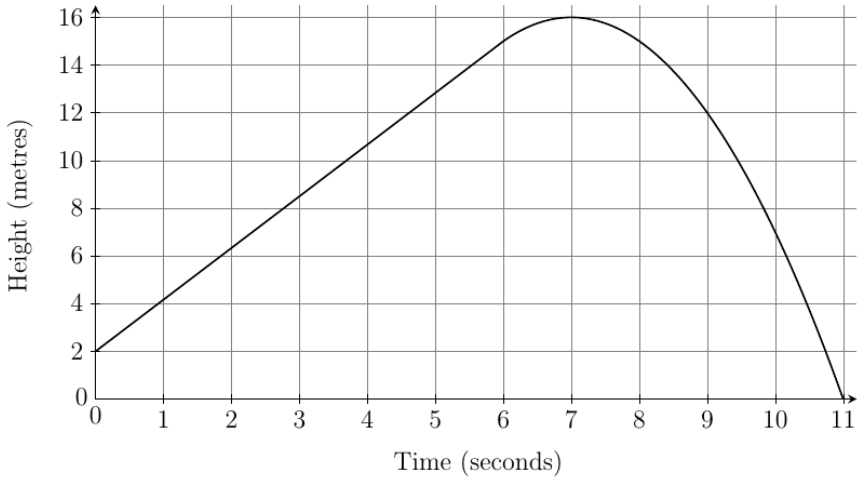
a. If the area of the square is 25 cm^2, find the value of x. 2 marks

b. Show that the perimeter of the square is longer than its diagonal. 3 marks

Question 3 (10 marks)
An athlete throws a discus across a field from point, which is 2 metres above the ground.



For six seconds after the discus is thrown, the discus travels linearly and eventually reaches a height of 15 metres. The path of the discus is shown on the graph below, where the x-axis is at ground level.



a. Find the equation of the path of the discus during the first 6 seconds. 2 marks

After 6 seconds, the path of the discus can be modelled by a parabola $h = -(t - 7)^2 + 16$, where h is the height above the ground in metres and t is the time in seconds since the discus was thrown.

b. Is the parabola h concave up or concave down? 1 mark
Circle the correct answer.

Concave up Concave down

c. Use the equation for h to show that the maximum height reached by the discus is 16 m. 2 marks
Show all working.

d. Find the two times when the height of the discus will be 7 metres above the ground. 3 marks
Round any inexact answers to one decimal place.

e. The following sequence of transformations take the graph of $h = t^2$ to the graph of $h = -(t - 7)^2 + 16$. 2 marks
Write down the missing words or symbols in the two blank spaces.

1. A reflection in the horizontal axis. ($h = -t^2$)
2. A horizontal translation by 7 units to the right. (_____)
3. A vertical translation by ___ units up. ($h = -(t - 7)^2 + 16$)

END OF QUESTION AND ANSWER BOOK

SOLUTIONS

SECTION A

Question	Answer
1	C
2	B
3	E
4	D
5	C
6	A
7	C
8	D
9	E
10	A
11	D
12	C
13	B
14	D
15	B
16	E
17	A
18	D
19	C
20	B

Question 1

$\sqrt{5}\left(\sqrt{25}-\sqrt{5}\right)=5\sqrt{5}-5$

Answer is **C**.

Question 2

$$\frac{2^{4n+8}}{16^{n+1}}=\frac{2^{4n+8}}{2^{4n+4}}$$
$$=2^{4n+8-(4n+4)}$$
$$=2^4$$

Answer is **B**.

SECTION B

Question 1 (5 marks)

a. 2 marks

$$\frac{(a-3b)^2-6ab}{ab}=\frac{6^2-6\times1}{1} \quad \text{(A1)}$$
$$=30 \quad \text{(A1)}$$

b. 3 marks

Let $x=0.\dot{5}\dot{4}$. (A1)

Multiplying both sides of the equation by 100 gives $100x=54.\dot{5}\dot{4}$.

Subtracting the first equation from the second equation gives

$$100x-x=54.\dot{5}\dot{4}-0.\dot{5}\dot{4} \quad \text{(A1)}$$
$$99x=54$$
$$x=\frac{54}{99}$$
$$=\frac{6}{11} \quad \text{(A1)}$$

Question 2 (5 marks)

a. 2 marks

Using Pythagoras' theorem

$$BC=\sqrt{3^2+6^2} \quad \text{(A1)}$$
$$=\sqrt{45}$$
$$=3\sqrt{5}\text{ m} \quad \text{(A1)}$$

b. 3 marks

$$\frac{AC}{BM}=\frac{6}{3\sqrt{5}-6} \quad \text{(A1)}$$
$$=\frac{6}{3\sqrt{5}-6}\times\frac{3\sqrt{5}+6}{3\sqrt{5}+6} \quad \text{(A1)}$$
$$=\frac{18\left(\sqrt{5}+2\right)}{45-36}$$
$$=2\left(\sqrt{5}+2\right) \quad \text{(A1)}$$

Question 9 (5 marks)

a. 1 mark

8 (A1)

b. 3 marks

$x^2 + y^2 = 64$ represents a circle with a radius of 8 units. (A1)

Therefore, the area between the two circles is

$\pi \times 8^2 - \pi \times 4^2$ (A1)

$= 64\pi - 16\pi$

$= 48\pi$ (A1)

● Award full marks if it is implied that the radius of the second circle is 8 units.

c. 1 mark

Four times (A1)

Question 10 (5 marks)

a. 3 marks

$\left(2^5 + 2^5 + 2^5 + 2^5 + 2^5\right)\left(5^5 + 5^5 + 5^5 + 5^5\right)$

$= 5 \times 2^5 \times 4 \times 5^5$ (A1)

$= 20 \times 10^5$ (A1)

Therefore the number has 7 digits. (A1)

● Accept evaluating the number and then counting the number of its digits.

b. 2 marks

$56^x = (2^3 \times 7)^x$

$= \left(2^x\right)^3 \times 7^x$ (A1)

$= a^3 b$ (A1)

SECTION C

Question 1 (10 marks)

a. 2 marks

$x^2 = 25$ (A1)

$x = 5$ (A1)

b. 3 marks

The perimeter of the square is $4x$ cm. (A1)

The diagonal of the square is $\sqrt{x^2 + x^2} = \sqrt{2x^2} = \sqrt{2}x$ cm. (A1)

Since $\sqrt{2}x < 4x,$ the perimeter is longer than the diagonal. (A1)

● Accept assuming that $\sqrt{2} < 4$ without proof.

c. 4 marks

$(x+3)^2 - 18 = 2x^2$ (A1)

$x^2 + 6x + 9 - 18 = 2x^2$

$x^2 - 6x + 9 = 0$ (A1)

$(x-3)^2 = 0$

$x = 3$ (A1)

Therefore, the side length of the new square is 6 cm. (A1)

d. 1 mark

The area of this square is

$$\left(\frac{7x}{5}\right)^2$$

$$= \frac{49x^2}{25}$$

$$= \frac{196x^2}{100}$$

$$= \left(1 + \frac{96}{100}\right)x^2$$

● Accept either of the last two lines. (A1)