2022 Year 10 (5.1/5.2/5.3) Topic Tests Information Sheet (NSW)

2022 Year 10 (5.1/5.2/5.3) Topic Tests are sets of short answer questions and their solutions. We offer the following sets:

Year 10 (5.1) set
- Financial Mathematics (3 questions)
- Indices and Numbers of Any Magnitude (2 questions)
- Linear Relationships (2 questions)
- Measurement (3 questions)
- Trigonometry (2 questions)
- Geometrical Figures (3 questions)
- Probability (2 questions)
- Single Variable Statistics (2 questions)
- Mid-year Test

Year 10 (5.2) set
- Financial Mathematics (2 questions)
- Algebraic Expressions and Indices (3 questions)
- Linear Relationships (2 questions)
- Quadratics and Non-linear Relationships (3 questions)
- Measurement (2 questions)
- Trigonometry (3 questions)
- Geometrical Figures (3 questions)
- Probability (2 questions)
- Single Variable and Bivariate Statistics (2 questions)
- Mid-year Test

Year 10 (5.3) set
- Indices and Surds (2 questions)
- Expressions, Equations and Linear Relationships (2 questions)
- Measurement (2 questions)
- Quadratic Expressions, Quadratic Equations and Parabolas (2 questions)
- Trigonometry (3 questions)
- Geometrical Figures (3 questions)
- Non-linear Relationships, Functions and Their Graphs (3 questions)
- Logarithms and Polynomials (3 questions)
- Single Variable and Bivariate Statistics (2 questions)
- Mid-year Test

The structure of each **Mid-year Test** is:
- 15 multiple choice questions
- 5 short answer questions
- 2 extended response questions

Distribution
Electronic copies will be emailed to you

File format
MS Word DOCX format and PDF format

Release date
1st of March 2022

Pricing
$105 per set

End-of-year exams
Two version of end-of-year exams will be on sale early September

2022 Year 10 (5.1) Mathematics
Financial Mathematics Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (8 marks)

a. $5,000 is invested at 5.4% p.a. compounding annually.   2 marks
Write the value of the investment after n years in the form $a \times b^c$.

_____

_____

b. The following table shows the interest and the ending balance of a compound interest loan in the first three years. Assume that no repayments are made.

Year	Starting Balance	Interest	Ending Balance
1	$9,200	$588.80	$9,788.80
2	$9,788.80	$626.48	$10,415.28
3	$10,415.28	$666.58	$11,081.86

  i. Use the values in the first row to show that the interest rate of the loan is 6.4% per annum.   1 mark

_____

_____

  ii. Find the value of the loan after four years.   2 marks

_____

_____

_____

iii. Suppose another loan of $9,200 is taken out at $r\%$ simple interest per annum.   3 marks
After two years, the value of the simple interest loan and the compound interest loan shown above are equal.
Find the value of r, rounding your answer to one decimal place.

_____

_____

_____

2022 Year 10 (5.1) Mathematics
Indices and Numbers of Any Magnitude Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (11 marks)

a. Write a simplified algebraic expression to represent "multiplying four Ts together".　　2 marks

_____

b. Simplify $4x^3 \times x^2$.　　2 marks

_____

_____

c. Simplify $(16y^3z \div (4y^{-2}z))^2$.　　2 marks

_____

_____

d. Write $(2s^{-2}t^{-4})^{-3}$ using positive indices only.　　2 marks

_____

_____

_____

**e. i.** What does 5^x evaluates to when $x = 0$?　　1 mark

_____

ii. Find the value of x when 5×5^x is equal to $\dfrac{1}{25}$.　　2 marks

_____

_____

_____

Question 1 (12 marks)
Consider the three straight lines A, B and C.
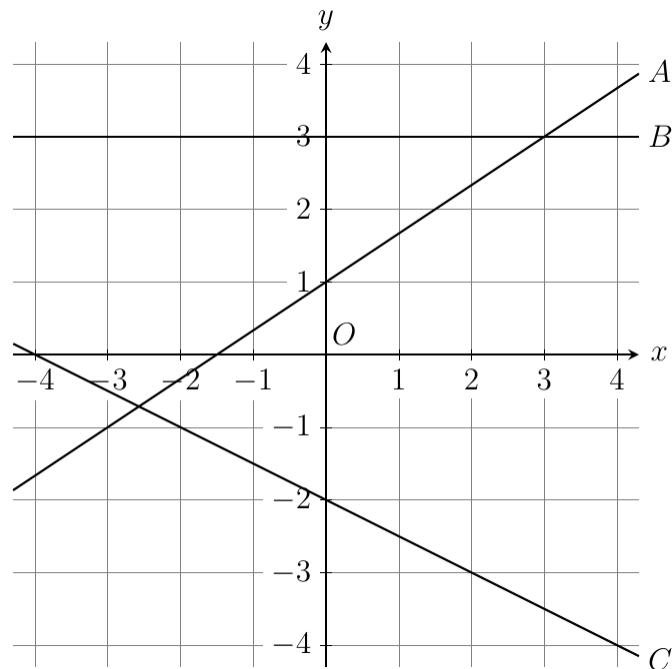
a. Write down the gradient of line B.   1 mark

_____

**b.** Write down the equation of line B.   1 mark

_____

_____

c. Find the equation of line C.   2 marks

_____

_____

Question 2 (8 marks)

A scanner purchased for $450 by a small business is depreciated each month as shown on the graph below.
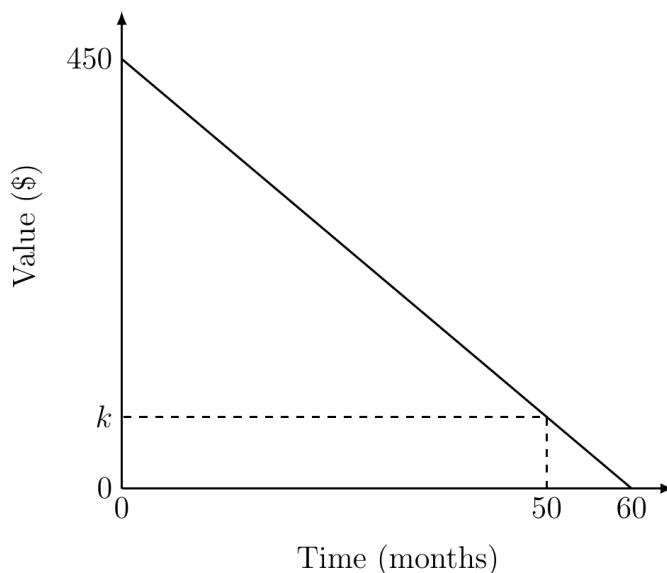
a. Show that the scanner depreciates by $7.50 per month.   1 mark

_____

b. Write down the equation of the graph in terms of *value* and *time*.   2 marks

$$Value = \boxed{} - \boxed{} \times \ time$$

c. The value of the scanner reduces to k after 50 months.   2 marks
Find the value of k.

_____

_____

_____

d. Find the time taken for the value of the scanner to reduce to $300.   2 marks

_____

_____

_____

2022 Year 10 (5.1) Mathematics
Measurement Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (7 marks)
**a.** Write down the number of significant figures in 56.08.   1 mark

_____

b. The weight of an apple is measured to be 799 g.   2 marks
Give the limits of accuracy of this measurement.

_____

_____

c. The following diagram shows the areas of a children's basket court and a standard basket court.   2 marks
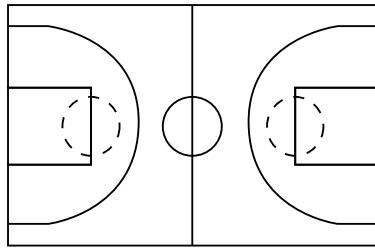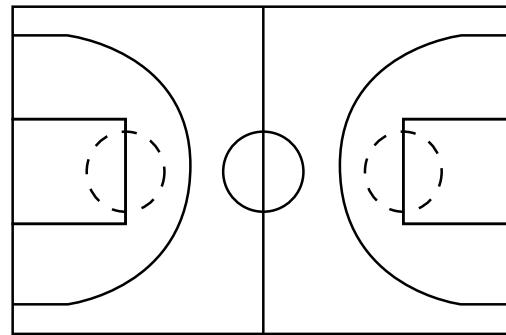

770,000 cm^2 420 m^2

Find the combined areas of the two basketball courts in cm^2.

_____

_____

_____

_____

Question 3 (9 marks)
Consider the following prism.
The cross-section of this prism is an equilateral triangle.
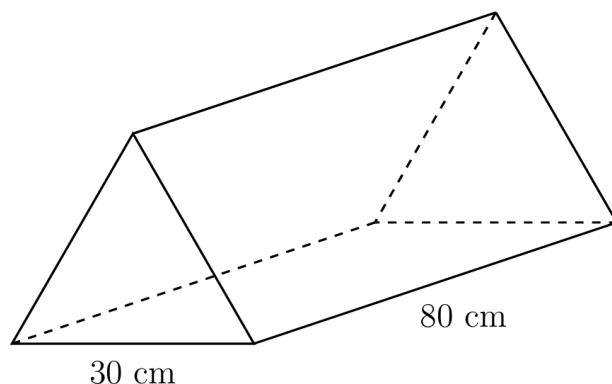

a. State the name of the prism.   1 mark

_____

b. Complete the diagram below for the net of the prism.   3 marks
   Include any relevant measurements.
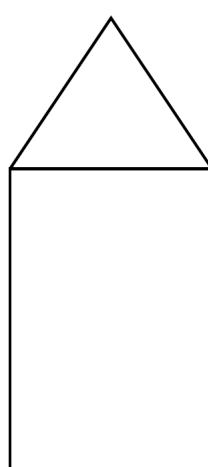
Question 2 (9 marks)

a.   2 marks

$\dfrac{1}{2} \times \pi \times 2^2$ (A1)

$= 2\pi$ cm^2 (A1)

b.   2 marks

$\dfrac{1}{2} \times \pi \times 2^2 : \dfrac{1}{2} \times \pi \times 4^2$ (A1)

$= 4 : 16$

$= 1 : 4$ (A1)

● Accept $4^2 : 8^2 = 16 : 64 = 1 : 4$.

c.   2 marks

$\dfrac{1}{2} \times \pi \times 2^2 + \dfrac{1}{2} \times \pi \times 4^2$ (A1)

≈ 31.4 cm^2 (A1)

d.   3 marks

The perimeter of the composite shape is

$\dfrac{1}{2} \times (2 \times \pi \times 2) + \dfrac{1}{2} \times (2 \times \pi \times 4) + 4$ (A1)

$= 22.849...$ cm   (A1)

Since 23 cm is longer than 22.849… cm, the string is long enough. (A1)

Question 1 (10 marks)
Consider the following diagram.
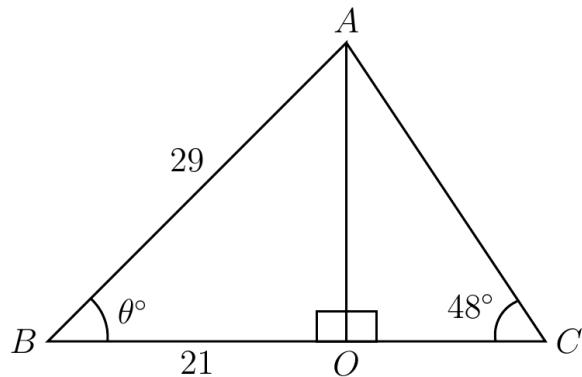
a. Show that the length of AO is 20. 1 mark

_____

_____

b. Write down the value of $\cos(\theta°)$ as a fraction. 1 mark

_____

_____

c. Find the value of θ. 2 marks
  Round your answer to one decimal place.

_____

_____

d. Find the value of AC. 2 marks
  Round your answer to the nearest whole number.

_____

_____

The boat moves towards the cliff to point *B'* such that the new horizontal distance between Simon and the boat is 55 m.
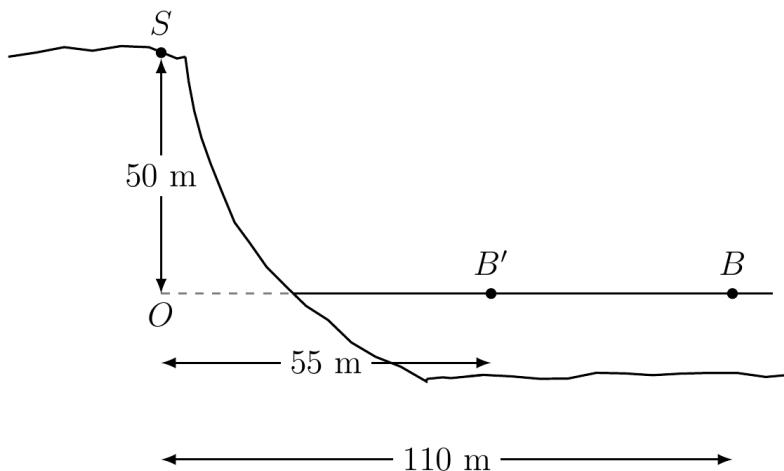
d. How has the angle of depression of the boat from Simon changed?   1 mark
Circle the correct answer.

            No change   Increased   Decreased

e. Are angle *OSB'* and angle *B'SB* equal?   3 marks
Justify your answer.

_____

_____

_____

_____

_____

_____

**2022 Year 10 (5.1) Mathematics
Trigonometry Test
Total marks: 20 marks**

Question 1 (10 marks)

a.   1 mark

By Pythagoras' theorem

$$AO = \sqrt{29^2 - 21^2} = \sqrt{400} = 20 \quad \text{(A1)}$$

b.   1 mark

$$\cos(\theta^\circ) = \frac{21}{29} \quad \text{(A1)}$$

c.   2 marks

$$\theta = \cos^{-1}\left(\frac{21}{29}\right) \quad \text{(A1)}$$

$$\approx 43.6^\circ \quad \text{(A1)}$$

d.   2 marks

$$\frac{20}{AC} = \sin(48^\circ) \quad \text{(A1)}$$

$$AC = \frac{20}{\sin(48^\circ)}$$

$$\approx 27 \quad \text{(A1)}$$

e.   2 marks

$$\sin(48^\circ) = \frac{AO}{AC} = \cos(42^\circ)$$

● Correct working. (A1)

Therefore, $x = 42$. (A1)

f.   2 marks

$$\sin^{-1}\left(\frac{21}{29}\right) + (90^\circ - 48^\circ) \quad \text{(A1)}$$

$$\approx 88^\circ \quad \text{(A1)}$$

Question 1 (10 marks)
The diagram below shows five rectangles on the square grid. The side length of each square is 1 cm.
Rectangle A is similar to rectangle D.
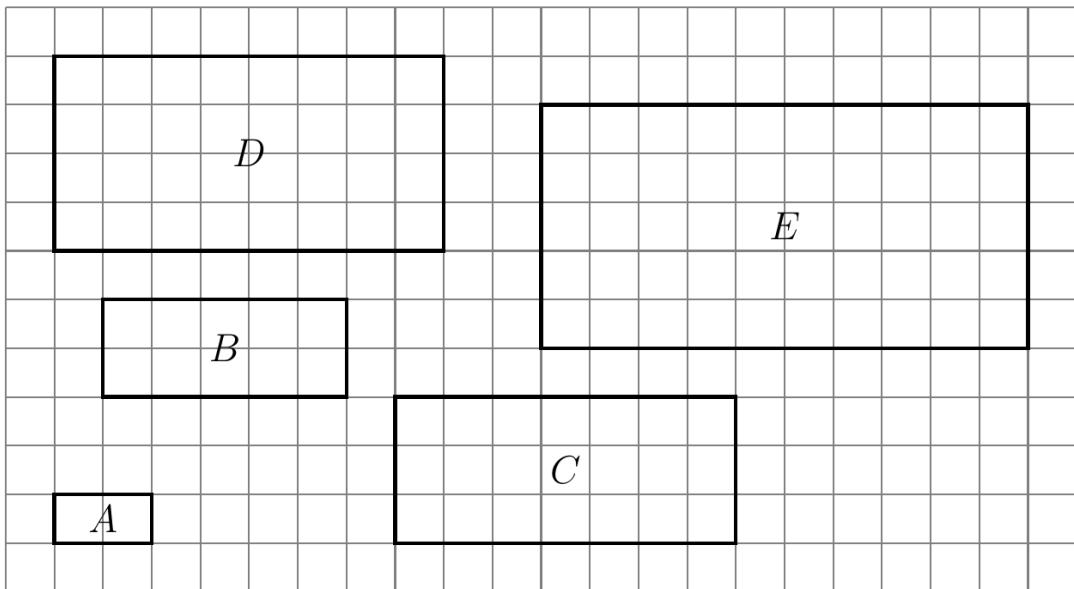
a. Complete the following sentence by writing down the appropriate word or number.   1 mark

  Rectangle A and rectangle B are not similar since the corresponding sides are _____ equal.

b. Find the scale factor that enlarges rectangle A to rectangle D.   2 marks

_____

_____

c. Circle the symbol used to denote similarity between shapes.   1 mark

          || ||| ≡   =

d. Which one of the following rectangles is also similar to rectangle A?   1 mark
    Circle the correct answer.

          B C E

Question 2 (6 marks)

a.   1 mark

Yes (A1)

b.   2 marks

The diameter of the larger circle is

$2 \times 10.5 \times 1.5$ (A1)

$= 31.5$ m (A1)

c.   2 marks

$1.5^2 = 2.25$

● Correct calculation. (A1)

Therefore, the ratio is $1 : 2.25$. (A1)

● Accept $\dfrac{\pi \times (10.5 \times 1.5)^2}{\pi \times 10.5^2} = 1.5^2 = 2.25$ for the working.

d.   1 mark

$\dfrac{1}{2.25} = \dfrac{4}{9}$ (A1)

**Question 3** (3 marks)

Using the hint gives 1 km² = 10,000,000,000 cm².

$15 \times 10,000^2$ (A1)

$= 1,500,000,000$ cm² (A1)

$= 0.15$ km² (A1)

2022 Year 10 (5.1) Mathematics
Probability Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (9 marks)
Five numbered discs are placed face-down on a coffee table.
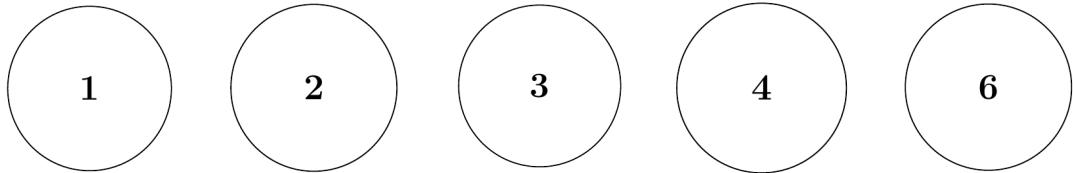
A disc is randomly chosen and its number is recorded.
The table below shows the results from randomly selecting100 discs.

Number	1	2	3	4	6
Frequency	18	17	22	20	23

a. State the sample space for the experiment.   1 mark

_____

b. Find the experimental probability of choosing an odd number.   2 marks
   Write your answer as a fraction in simplest form.

_____

_____

c. The experimental probability of choosing a number at least 3 is 0.65.

   i. Find the theoretical probability of choosing a number at least 3.   2 marks
      Write your answer as a decimal.

_____

_____

   ii. Would one expect the experimental probability and theoretical probability for this event   2 marks
   to be close to each other?
      Explain your answer.

_____

_____

Question 2 (11 marks)

a. 1 mark

$56 - (28 + 10) = 18$ (A1)

b. 3 marks
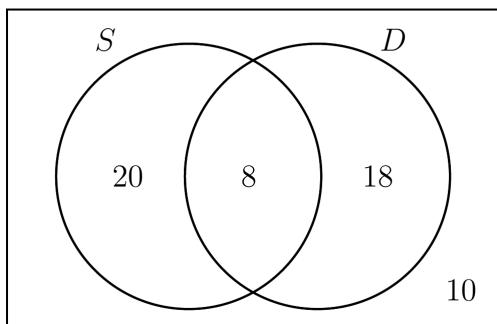
● All numbers are correct (A1)×3
● Penalise 1 mark per error.

c.

i. 2 marks

$\dfrac{18}{56}$ (A1)

$= \dfrac{9}{28}$ (A1)

ii. 2 marks

$\dfrac{20+18}{56}$ (A1)

$= \dfrac{38}{56}$

$= \dfrac{19}{28}$ (A1)

d. 1 mark

Since the probability that a person can both sing and dance is not 0. (A1)

e. 2 marks

	S	not S	
D	8	**18**	**26**
not D	**20**	10	**30**
	28	**28**	56

● All numbers are correct. (A1)×2
● Penalise 1 mark per error.

2022 Year 10 (5.1) Mathematics
Single Variable Statistics Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (9 marks)
Read the following paragraph to answer the questions that follow.

It has been said that 94 per cent of Australians between the ages of 15 and 17 have a smart phone. The Australian Bureau of Statistics found that teenagers, from several major cities in Australia between the ages of 15 and 17, are the biggest internet users, with 99 per cent of the people in that age group using the web. The time Australian teens use the internet is primarily spent on social media applications.

a. In the context of the survey, write down the statistical term used to refer to all of Australian teenagers aged between 15 and 17.   1 mark

_____

b. What is the data type of the variable "whether or not a teenager has a smartphone"?   1 mark
Circle the correct answer.

         Categorical   Numerical

c. The article states that "94 per cent of Australians between the ages of 15 and 17 have a smart phone".   2 marks
Does this mean that exactly 6 percent of Australians between the ages of 15 and 17 do not have a smartphone? Justify your answer.

_____

_____

d. The Australian Bureau of Statistics conducted a random sample instead of a census.   2 marks
State two different possible reasons why they did this.

_____

_____

e. Could the findings from the Australian Bureau of Statistics be applied to all Australian teenagers   2 marks
between the ages of 15 and 17?
Justify your answer.

_____

_____

Question 2 (11 marks)

a.   1 mark

15 (in each group) (A1)

b.   2 marks

$$\frac{59+64+...+95+102}{15} \quad \text{(A1)}$$

$= 78$ km/h (A1)

c.   2 marks

The median speed for weekdays is 75 km/h.
The median speed for weekend is 64 km/h.

● Correctly stating the median speeds. (A1)

The median speed is greater for weekdays than that for weekend. (A1)

d.   2 marks

$$\frac{9}{30} \times 100 \quad \text{(A1)}$$

$= 30\%$ (A1)

e.   2 marks

The distribution of speed on weekdays is <u>symmetric</u>, (A1) whereas the distribution of speed on the weekend is <u>positively-skewed</u>. (A1)

f.   2 marks

Possible answers are:
● It involves a lot of work to plot data with a large number of data points.
● It cannot be used to plot categorical data.
● The speeds of the cars seem to have been rounded to the nearest whole number.

● Two valid statements. (A1)×2

2022 YEAR 10 (5.1) MATHEMATICS
MIDYEAR TEST

Reading time: 15 minutes
Writing time: 2 hours

QUESTION BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	15	15	15
B	5	5	25
C	2	2	20
			Total 60

SECTION A

Question 1

$s^3 t^2 \times (s^{-2} t)$ simplifies to

A. st

B. st^2

C. st^3

D. $s^5 t^3$

E. $s^5 t$

Question 2

Paul normally works 38 hours per week and gets paid $16.50 per hour working as a waiter.
He receives time-and-a-half if he works additional hours.
Paul's gross income if he works 45 hours one week is

A. $173.25

B. $627

C. $742.50

D. $800.25

E. $1,113.75

**Question 3**

Shop A and Shop B both sell the cap shown below.
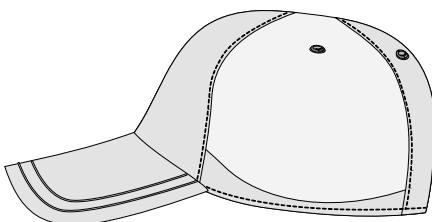
Shop A sells the cap for $25.50 and offers half price on any subsequent items bought.
Shop B normally sells the cap for $28, but is currently offering a 30% discount on all items in store.
Which one of the following statements is **true**?

A. It is cheaper to buy one cap at Shop A

B. It is cheaper to buy two of the caps at Shop A

C. It is cheaper to buy two of the caps at Shop B

D. It costs the same to buy two of the caps at either shop

E. It costs $38.25 to buy two caps at Shop B

Question 12
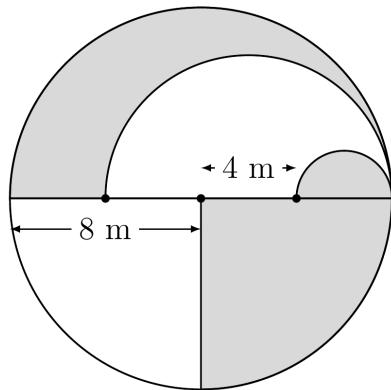
The area of the shaded region in the diagram above is closest to

A. 50.3 m^2

B. 94.2 m^2

C. 100.5 m^2

D. 106.8 m^2

E. 150.8 m^2

Question 13

In the following diagram, $AB = AC$ and $BE = CD$.
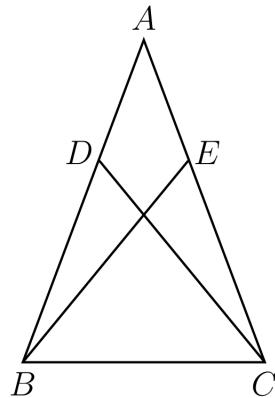
Which one of the following statements is **true**?

A. Triangle ABE and triangle ACD are similar but not congruent

B. Triangle ABE and triangle ACD are not similar

C. Triangle ABE and triangle ACD are not congruent

D. Triangle ABE and triangle ACD are similar and congruent

E. Triangle ABE and triangle ACD are not similar and not congruent

Question 3 (5 marks)
The diagram below shows a running track on a field.
This track has four signs A, B, C and D.
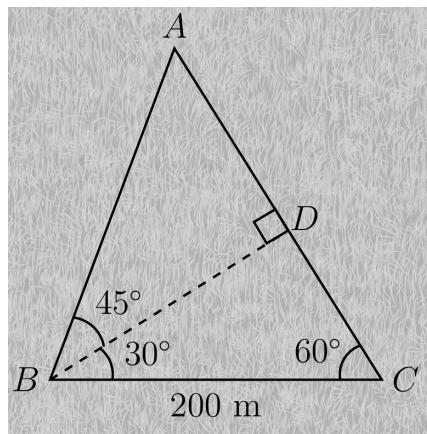
a. Show that $CD = 100$ m.   1 mark

_____

_____

_____

b. Show that $AD = BD$.   1 mark

_____

_____

_____

c. Jenny walks around the track via route A, B, C then back to A.   3 marks
   Find the distance that Jenny travels.
   Round your answer to one decimal place.

_____

_____

_____

_____

_____

SECTION C

Question 1 (10 marks)

Ryan worked as a consultant during the 2021-22 financial year.

The following is his financial summary.

Gross income from employer	$125,000
Work-related expenses	$850
Interest on investments	$550

Resident tax rates 2021–22

Taxable income	Tax on this income
$120,001 – $180,000	$29,467 plus 37 cents for each $1 over $120,000

Source: ATO website

Ryan must also pay the Medicare levy, calculated as 2% of his taxable income.

a. Show that Ryan's taxable income is $124,700.   1 mark

_____

b. Use the 2021-22 tax table above to calculate the amount of Ryan's income tax payable.   2 marks

_____

_____

c. Find the total amount of tax that Ryan needs to pay for the 2021-22 financial year.   3 marks

_____

_____

_____

2022 YEAR 10 (5.1) MATHEMATICS MIDYEAR TEST

SOLUTIONS

SECTION A

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

Question 1
$$s^3t^2 \times (s^{-2}t) = st^3$$

Answer is **C**.

Question 2
Paul's gross income is
$$38 \times \$16.50 + 7 \times \$16.50 \times 1.5 = \$800.25$$

Answer is **D**.

Question 3
Shop A
The cost of buying two caps is $\$25.50 + \$25.50 \times 0.5 = \$38.25$

Shop B
The cost of buying two caps is $2 \times \$28 \times 0.7 = \$39.20$

Therefore, it is cheaper to buy two caps at Shop A.

All the other statements are false.

Answer is **B**.

Question 2 (10 marks)

a.   2 marks

$\dfrac{290}{1.61}$ (A1)

≈ 180.12 miles   (A1)

b.

i.   2 marks

$\dfrac{290 \text{ km}}{100 \text{ km/h}} = 2.9$ hours   (A1)

$2.9 \times 60 = 174$ minutes   (A1)

ii.   3 marks

After t hours, James travelled

$290 \times \dfrac{43}{43+15} = 215$ km   (A1)

Therefore

$t = \dfrac{215 \text{ km}}{100 \text{ km/h}}$ (A1)

$= 2.15$ (A1)

c.   3 marks

In the last 0.8 hours, the truck travelled

$78.75 \times 0.8 = 63$ km   (A1)

This means that in the first 1 hour and 12 minutes, the truck travelled

$159 - 63 = 96$ km   (A1)

Therefore, the speed of the truck in the first 1 hour and 12 minutes is

$\dfrac{96 \text{ km}}{1.2 \text{ h}} = 80$ km/h   (A1)

2022 Year 10 (5.2) Mathematics
Financial Mathematics Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (13 marks)

a. Michael invests $6,000 at 4.6% compounding annually.　　　　　　　　　　2 marks
  Find the value of Michael's investment after three years.

_____

_____

b. Rebecca takes out a personal loan of $12,500.
  Determine the value of the interest incurred after a year for each of the following rates:

  i. 12% p.a. compounded quarterly　　　　　　　　　　　　　　　　　　2 marks

_____

_____

  ii. 12% p.a. compounded weekly.　　　　　　　　　　　　　　　　　　2 marks

_____

_____

c. A laptop purchased for $2,400 depreciates in value every year.
  The value of the laptop n years after purchase is given by $A = 2400 \times 0.7^n$.

  i. Write down the annual rate of depreciation as a percentage.　　　　　　1 mark

_____

  ii. In which year will the value of the laptop be less than one third of its original value for the　　3 marks
  first time?

_____

_____

_____

_____

d.   **3 marks**
Option 1: 2.5% per annum, compounded monthly

$$A = \$250,400 \times \left(1 + \frac{2.5}{100} \times \frac{1}{12}\right)^{36} \approx \$269,881.14 \quad \text{(A1)}$$

Option 2: Simple interest at 2.59% per annum

$$A = \$250,400 + \$250,400 \times \frac{2.59}{100} \times 3 = \$269,856.08 \quad \text{(A1)}$$

Therefore, Marc is better off with **Option 1**. (A1)

2022 Year 10 (5.2) Mathematics
Algebraic Expressions and Indices Test

Time allowed: 1 hour
Total marks: 30 marks

Question 1 (12 marks)

a. Expand and simplify $(x + 4)(x - 3)$.   2 marks

b. Factorise $20p^5q^2 - 15p^3q^3$.   2 marks

c. Simplify $\dfrac{20y}{6} \div \dfrac{4y}{3}$.   2 marks

d. Simplify $(3a^{-2})^2 \times 3a^{-1}$, expressing your answer using only positive indices.   2 marks

e. Factorise $y^2 - 6y - 7$.   2 marks

f. When the minute hand of a clock moves by m°, the hour hand moves h°. Find h in terms of m, expressing your answer as a fraction in simplest form.   2 marks

Question 3 (10 marks)

a. The result of adding 3 to four times a positive integer is equal to the result of subtracting 7 from   2 marks
six times the positive integer.
Find the positive integer.

_____

_____

_____

_____

b. The perimeter of the composite shape below is 84.   3 marks
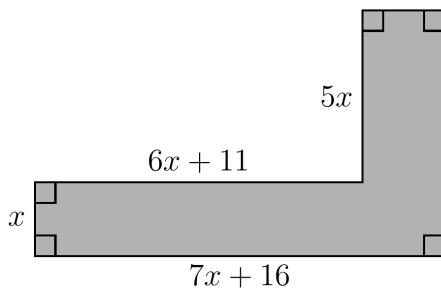
Find the value of x.

_____

_____

_____

_____

_____

_____

Question 2 (8 marks)

a.   3 marks

$$\frac{x}{5} - \frac{x}{2} = -3$$

$$10 \times \left(\frac{x}{5} - \frac{x}{2} \right) = 10 \times (-3)$$

$$2x - 5x = -30 \quad \text{(A1)}$$

$$-3x = -30 \quad \text{(A1)}$$

$$x = 10 \quad \text{(A1)}$$

● Accept writing LHS as a single fraction.

b.   2 marks

$$-k^2 + 2kx + 3 = 0$$

$$-9 - 6x + 3 = 0 \quad \text{(A1)}$$

$$-6x = 6$$

$$x = -1 \quad \text{(A1)}$$

c.

i.   2 marks

$$5x - 1 < 3x + 5$$

$$2x < 6 \quad \text{(A1)}$$

$$x < 3 \quad \text{(A1)}$$

ii.   1 mark
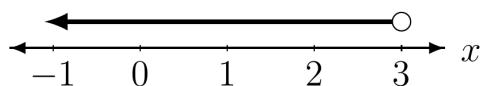
● Open circle at $x = 3$ and solid arrow pointing to the left. (A1)

Question 1 (11 marks)

a. Consider the straight line shown below.
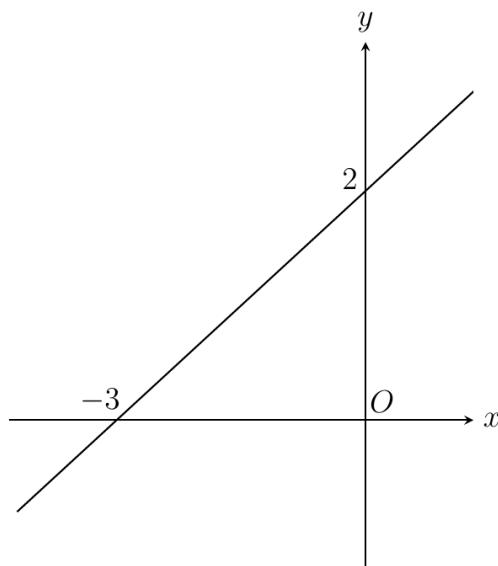
i. Find the equation of the line. 2 marks

_____

_____

ii. Find the gradient of a line that is a perpendicular to the line shown above. 2 marks

_____

_____

b. A straight line with a gradient of –3 passes through the point $(2, -2)$. 2 marks
Write down the equation of the line in general form (i.e. $ax + by + c = 0$).

_____

_____

_____

Question 2 (9 marks)

a. A car consumes 1 L of petrol per 20 km of distance travelled.

Let y L be the amount of petrol consumed by the car after it has travelled x km.

The point $(k, 10)$ lies on the graph of y versus x.
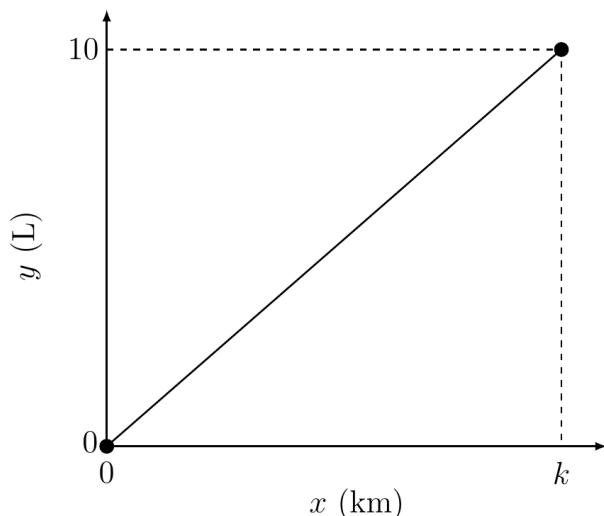
i. How can the relationship between x and y be described?   1 mark

_____

ii. Find the rule relating x and y.   2 marks

_____

_____

iii. Find the value of k.   2 marks

_____

_____

iv. Explain the meaning of k in the context given.   2 marks

_____

_____

2022 Year 10 (5.2) Mathematics
Linear Relationships Test
Total marks: 20 marks

Question 1 (11 marks)
a.
i.   2 marks

$$y = \frac{2}{3}x + 2$$

- Correct gradient $\frac{2}{3}$. (A1)

- Correct constant term 2. (A1)

ii.   2 marks
Let the gradient of the perpendicular line be m.

$$m \times \frac{2}{3} = -1 \quad \text{(A1)}$$

$$m = -\frac{3}{2} \quad \text{(A1)}$$

b.   2 marks
The equation of the line is $y = -3x + 4$. (A1)

Writing this equation in general form gives $3x + y - 4 = 0$. (A1)

- Any multiple of the final answer should also be accepted.

c.   3 marks
Writing the equations $6x + ay - 8 = 0$ and $2x - 5y - b = 0$ in gradient-intercept form gives

$$y = -\frac{6}{a}x + \frac{8}{a} \text{ and } y = \frac{2}{5}x - \frac{b}{5}.$$

- Correctly wrote the equations in gradient-intercept form. (A1)

Since the lines are parallel to each other

$$-\frac{6}{a} = \frac{2}{5}$$

$$a = -15 \quad \text{(A1)}$$

Since these lines are distinct

$$-\frac{b}{5} \neq \frac{8}{a}$$

$$b \neq \frac{8}{3} \quad \text{(A1)}$$

2022 Year 10 (5.2) Mathematics
Quadratics and Non-linear Relationships Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (5 marks)
a. Consider the graph shown below.
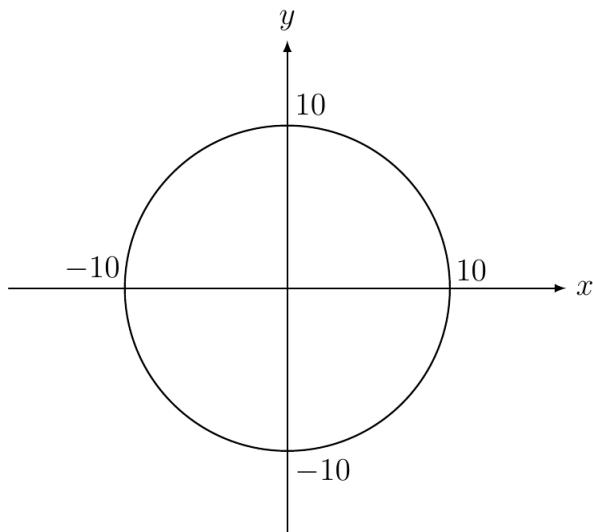
i. Write down the equation of the graph. 1 mark

_____

ii. Determine whether or not the point $(8, 12)$ lies on the graph. 2 marks

_____

_____

b. Do a straight line and a circle always intersect? 1 mark
   Circle the correct answer.

Yes No

c. Write the equation of a circle centred at the origin with a radius of $4R$. 1 mark

_____

Question 3 (12 marks)
a. Consider the graph of the equation $y = x^2 - 9$.

   i. Complete the following table summarising the key features of the graph.   4 marks

Axis of symmetry	
Coordinates of turning point	
x-intercepts	
y-intercept	$y = -9$

   ii. Sketch the graph of $y = x^2 - 9$ on the set of axes below.   3 marks
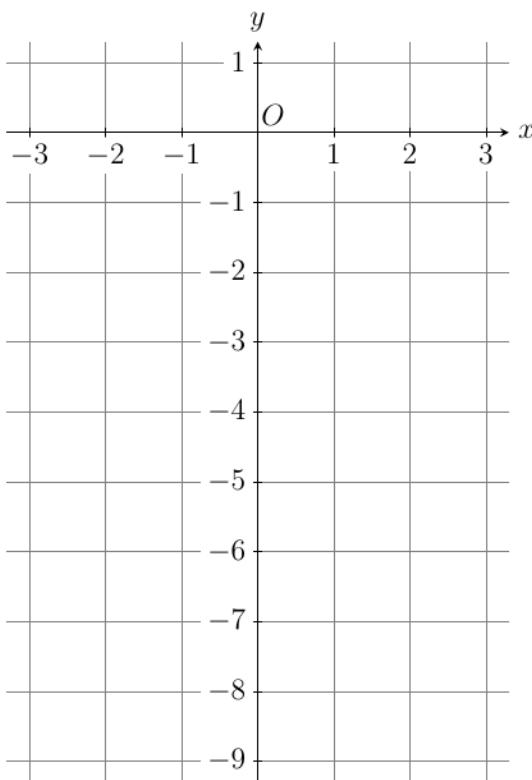
   iii. State the type of transformation that takes the graph of $y = x^2 - 9$ to the graph of $y = 3(x^2 - 9)$.   1 mark
   You do not need to specify the magnitude of the transformation.

_____

b. $\hspace{10cm}$ **4 marks**

$$(x+4)(x+5) = 20+10 \quad \text{(A1)}$$
$$x^2 + 9x + 20 = 30$$
$$x^2 + 9x - 10 = 0 \quad \text{(A1)}$$
$$(x+10)(x-1) = 0$$
$$x = -10, \ 1 \quad \text{(A1)}$$

Note that $x > 0$ since x represents length. Therefore, only $x = 1$ is a valid solution.

● This justification is not required.

Therefore, the length of the new rectangle is $x + 5 = 1 + 5 = 6$ m. (A1)

2022 Year 10 (5.2) Mathematics
Measurement Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (11 marks)
The following diagram shows a rectangular prism that has a smaller rectangular prism removed in the middle.
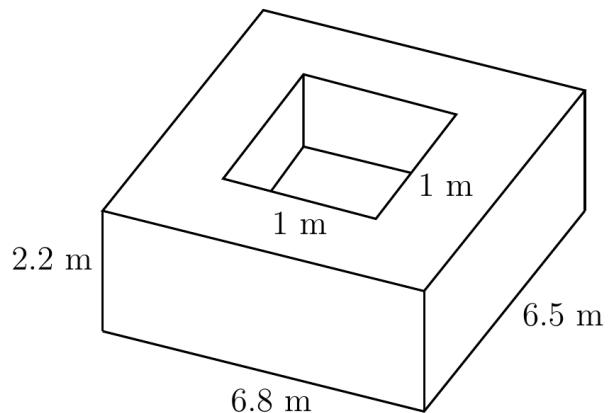
a. Find the area of the cross-section of the solid. 2 marks

_____

_____

b. Find the volume of the solid. 2 marks

_____

_____

_____

c. Convert your answer to part **b** to cm^3. 1 mark

_____

_____

Question 2 (9 marks)
A composite solid consist of a half-cylinder on top of a rectangular prism.
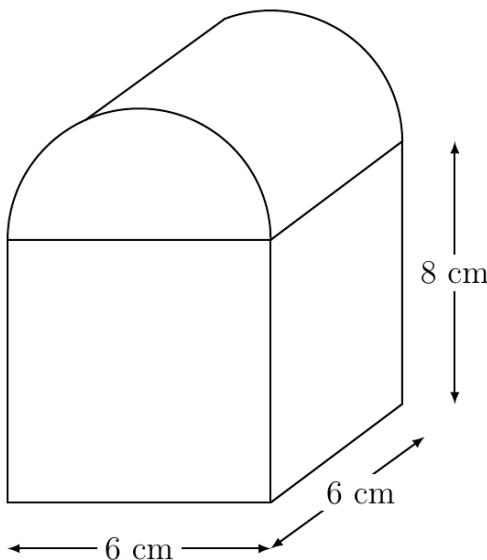
a. Show that the area of the cross-section of the composite solid is given by $(4.5\pi + 48)$ cm^2.   1 mark

_____

_____

b. Find the surface area of the composite solid, excluding the bottom face.   2 marks
   Round your answer to one decimal place.

_____

_____

_____

c. Find the ratio of the volume of the half cylinder to the volume of the rectangular prism.   3 marks
   Round your answer to two decimal places.

_____

_____

_____

_____

2022 Year 10 (5.2) Mathematics
Measurement Test
Total marks: 20 marks

Question 1 (11 marks)

a.   2 marks

The area of the cross-section is

$6.8 \times 6.5 - 1 \times 1$ (A1)

$= 43.2 \text{ m}^2$ (A1)

b.   2 marks

The volume of the solid is

43.2×2.2 (A1)

$= 95.04 \text{ m}^3$ (A1)

c.   1 mark

$95.04 \text{ m}^3 = 95{,}040{,}000 \text{ cm}^3$ (A1)

● Award consequential marks if correct method is applied using an incorrect answer to **b**.

d.   3 marks

The volume of the removed middle section is

$1 \times 1 \times 2.2$

$= 2.2 \text{ m}^3$

● Correct volume.   (A1)

This means that the hollow section can be filled with 2,200,000 mL of water.   (A1)

$\dfrac{2{,}200{,}000 \text{ mL}}{2{,}500 \text{ mL/min}} = 880 \text{ min}$ (A1)

e.   3 marks

The surface area of the solid is

$2 \times 43.2 + 2 \times 6.8 \times 2.2 + 2 \times 6.5 \times 2.2 + 4 \times 1 \times 2.2$ (A1)×2

$= 153.72 \text{ m}^2$ (A1)

2022 Year 10 (5.2) Mathematics
Trigonometry Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (10 marks)
A running track passes through four landmarks, *A*, *B*, *C* and *D* at a local park.
BC is parallel to *AD*.
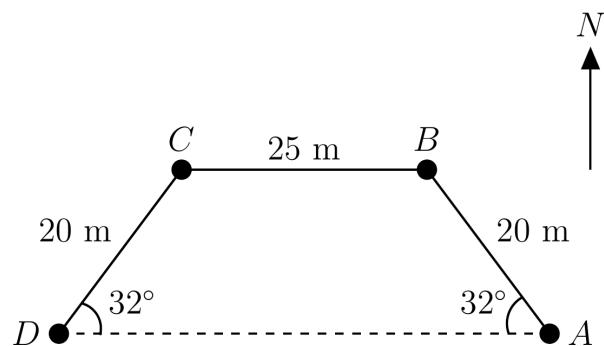
a. Show that the horizontal distance between *A* and *B* is given by $20\cos(32º)$.   1 mark

_____

_____

b. Show that angle *ABC* is 148º.   2 marks
   State any relevant geometrical reasoning.

_____

_____

c. Find the bearing of *A* from *B*.   2 marks

_____

_____

d. Jason jogs directly from *A* to *C*.   2 marks
   Find total distance travelled by Jason, rounding your answer to one decimal place.

_____

_____

_____

e. Find the amount by which the angle of depression from P to N exceeds that from Q to N.   3 marks
Round your answer to one decimal place.

_____

_____

_____

_____

2022 Year 10 (5.2) Mathematics
Trigonometry Test
Total marks: 25 marks

Question 1 (10 marks)
a.   1 mark

$$\frac{d}{20} = \cos(32°)$$

$$d = 20\cos(32°)$$

● Correct working is shown. (A1)

b.   2 marks
(90º – 32º) + 90º = 148º (A1)
The sum of interior angles of a triangle is 180º. (A1)

● Accept other valid methods.

c.   2 marks
90º + 32º = 122º (A1)
Therefore, the bearing of A from B is 122º. (A1)

d.   2 marks

$$AC = \sqrt{\left(20\cos(32°) + 25\right)^2 + \left(20\sin(32°)\right)^2}   \text{(A1)}$$

$$\approx 43.3 \text{ m} \text{(A1)}$$

e.   3 marks

$$\angle ACB = \tan^{-1}\left(\frac{20\sin(32°)}{20\cos(32°) + 25}\right)   \text{(A1)}$$

$$= 14.1751...° \text{(A1)}$$

Therefore, the bearing of A from C is
90º + 14.1751º $\approx$ 104º (A1)

2022 Year 10 (5.2) Mathematics
Geometrical Figures Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (10 marks)

a. A octagon is a polygon with 8 sides.

i. Show that the sum of the interior angles of an octagon is 1,080º. 1 mark

_____

_____

ii. The following diagram shows a regular octagon. 2 marks
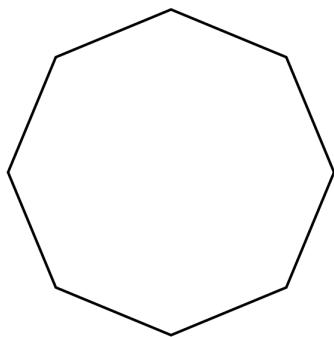
Find the size of an exterior angle of the regular octagon.

_____

_____

_____

Question 3 (7 marks)

Rectangle *PQRS* is similar to rectangle *STUR*, where *PQ* = 8 cm and *UR* = 4 cm.
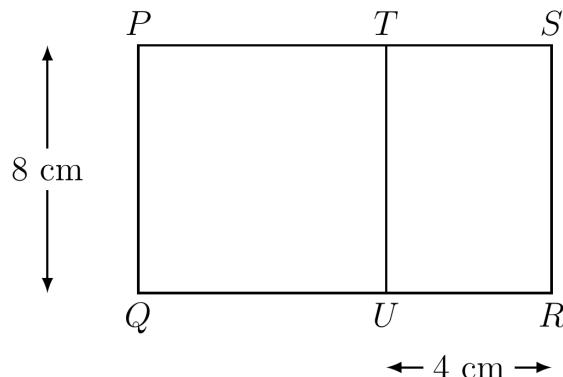
a. Find the length of *QU*.   4 marks

_____

_____

_____

_____

b. Is the ratio of the area of rectangle *STUR* to the area of rectangle *PQRS* 1 : 2?   2 marks
Determine this without calculating the areas of the rectangles.

_____

_____

c. Find the ratio of the perimeter of rectangle *STUR* to the perimeter of rectangle *PQRS*.   1 mark

_____

2022 Year 10 (5.2) Mathematics
Geometrical Figures Test
Total marks: 25 marks

Question 1 (10 marks)
a.
i.   1 mark
$(8 - 2) \times 180º = 1,080º$ (A1)

ii.   2 marks
The size of an interior angle is
$$\frac{1,080°}{8} = 135°$$ (A1)

Therefore, the size of an exterior angle is
$180º - 135º = 45º$ (A1)

● Also accept 360º/8 = 45º.

b.
i.   4 marks
Angle *YOZ* and angle *VOW* are equal since they are vertically opposite angles. (A1)
Angle *OYZ* and angle *OWV* are equal since they are alternate angles. (A1)
Angle *OZY* and angle *OVW* are equal since they are alternate angles. (A1)
By the AAA test, triangle *OYZ* and triangle *OVW* are similar. (A1)

● Award full marks for stating only one of the alternate angle lines since the AA test applies.

ii.   3 marks
The sum of angles *T*, *U*, *V* + *Z*, *W* + *Y* and *X* is equal to the sum of the interior angles of a pentagon. (A1)

Therefore, the sum is
$(5 - 2) \times 180°$ (A1)
$= 540°$ (A1)

2022 Year 10 (5.2) Mathematics
Probability Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (14 marks)
A group of Year 9 and Year 10 students were asked what their current extracurricular activity was. The following table shows the results.

	Chess	Debating	Sport	
Year 9	12	6	9	27
Year 10	8	10	15	33
	20	16	24	60

A student is selected randomly.

a. What is the probability that the student's activity is chess?   2 marks
Express your answer as a fraction in simplest form.

_____

_____

b. What is the probability that the student's activity is chess or sport?   2 marks
Express your answer as a fraction in simplest form.

_____

_____

c. Let X be the event that the chosen student's activity is sport, and let Y be the event that the chosen student is in Year 10.

i. Find $P(X \mid Y)$.   2 marks

_____

_____

ii. Is it true that $P(X \mid Y) = P(Y \mid X)$?   2 marks
Explain your answer.

_____

_____

Question 2 (6 marks)

A cricket team is having a match and they can wear either a blue or navy uniform.

The probability that the team will wear blue uniform is 0.45.

The probability that the team will win the match is 0.6.

The following tree diagram shows all possible outcomes.
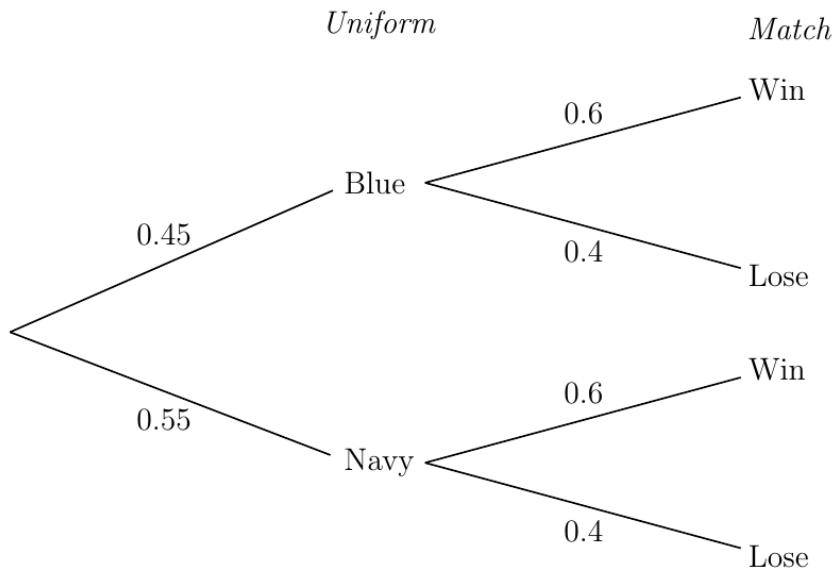
a. What is the probability that the team wears navy uniform and loses the match?   2 marks
   Write your answer as a decimal.

_____

_____

b. Use the tree diagram to explain why the result of the match is independent of the colour of the   1 mark
   uniform worn.

_____

_____

c. Show that $P(\text{Blue} \mid \text{win}) = P(\text{Blue})$.   3 marks

_____

_____

_____

_____

2022 Year 10 (5.2) Mathematics
Probability Test
Total marks: 20 marks

Question 1 (14 marks)
a.   2 marks

$P(\text{Chess}) = \dfrac{20}{60}$ (A1)

$\qquad\quad = \dfrac{1}{3}$ (A1)

b.   2 marks

$P(\text{Chess or Sport}) = \dfrac{20+24}{60}$ (A1)

$\qquad\qquad\qquad = \dfrac{44}{60}$

$\qquad\qquad\qquad = \dfrac{11}{15}$ (A1)

c.
i.   2 marks
$P(X \mid Y)$

$= \dfrac{15}{33}$ (A1)

$= \dfrac{5}{11}$ (A1)

ii.   2 marks
$P(Y \mid X)$

$= \dfrac{15}{24}$

$= \dfrac{5}{8}$

● Correct probability found. (A1)

Since $P(X \mid Y) \neq P(Y \mid X)$, the two probabilities are not equal. (A1)

2022 Year 10 (5.2) Mathematics
Single Variable and Bivariate Statistics Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (10 marks)
The following parallel box plots show the treatment times of patients receiving chiropractic and physiotherapy.
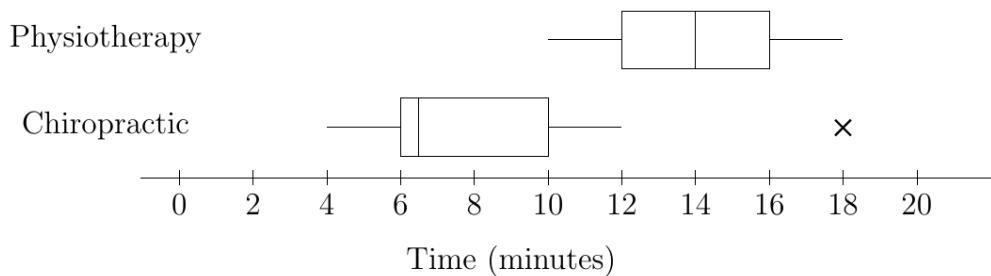
a. What is the maximum treatment time for physiotherapy patients?   1 mark

_____

b. What is the interquartile range for physiotherapy patients?   1 mark

_____

_____

c. What is the range for chiropractic patients?   1 mark

_____

d. What percentage of physiotherapy patients are treated longer than all chiropractic patients?   1 mark

_____

e. Show that the data value of 18 minutes is an outlier for chiropractic patients.   2 marks

_____

_____

Question 2 (10 marks)
The scatter plot below shows the number of quotations issued and the number of sales made for 11 car salespeople. The line of best fit is also drawn on the scatter plot.
The point $(169, 100)$ lies on the line of best fit.
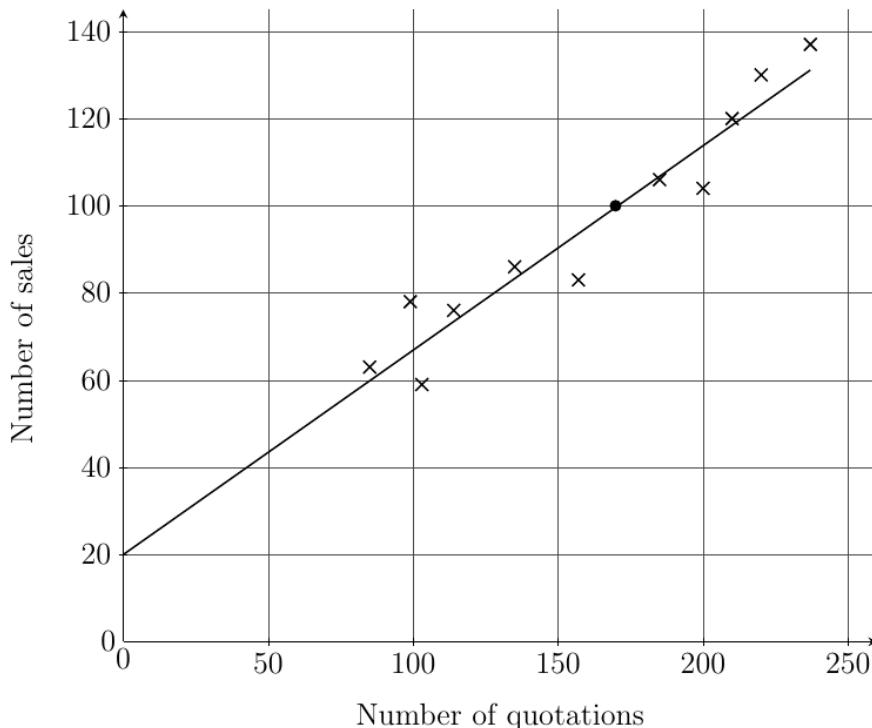
a. Explain the difference between univariate and bivariate data.   1 mark

_____

b. Does the scatter plot show that the number of quotations issued and the number of sales have   1 mark
a positive or negative correlation?
Circle the correct answer.

                      Positive   Negative

c. Give an interpretation of the direction of correlation specified in part **b**.   1 mark

_____

_____

d. Briefly describe the strength of the correlation between number of quotations and the number   2 marks
of sales.

_____

_____

Question 2 (10 marks)

a.   1 mark

Univariate data has one variable whereas bivariate data has two variables. (A1)

b.   1 mark

Positive (A1)

c.   1 mark

The number of sales increases as the number of quotations issued increases. (A1)

d.   2 marks

Most data points are clustered along the line of best fit. (A1)
This means that the correlation is fairly strong. (A1)

e.   2 marks

Number of sales $=$ number of quotations $\times 0.473 + 20$. (A1)$\times 2$

f.
i.   2 marks

Number of sales
$= 200 \times 0.473 + 20$. (A1)
$= 114.6$ (A1)

● Accept 115 sales.

ii.   1 mark

$104 - 114.6 = -10.6$ (A1)

● Accept $+10.6$.
● Accept ± 3 from the answer.

2022 YEAR 10 (5.2) MATHEMATICS
MIDYEAR TEST

Reading time: 15 minutes
Writing time: 2 hours

QUESTION BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	15	15	15
B	5	5	25
C	2	2	20
			Total 60

SECTION A

Question 1

Expanding and simplifying $3(4x - 5)(4x + 5)$ gives

A. $16x^2 - 25$

B. $48x^2 - 75$

C. $48x^2 - 25$

D. $16x^2 - 10$

E. $48x^2 - 30$

Question 2

The solutions to the simultaneous equations $3x + y = 11$ and $3x - 2y = -4$ are

A. $x = 2, y = 5$

B. $x = 5, y = 2$

C. $x = -2, y = 5$

D. $x = 2, y = -5$

E. $x = -2, y = -5$

Question 3

The number line that best represents the solution set to the inequality $\dfrac{3x - 2}{2} \geq 2$, where x is a positive integer, is

A.

B.

C.

D.

E.
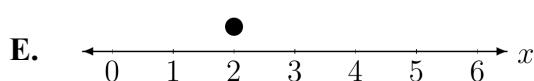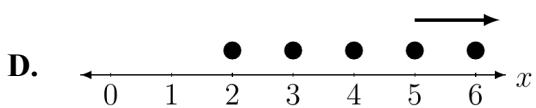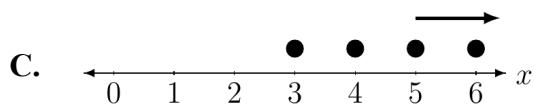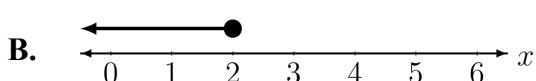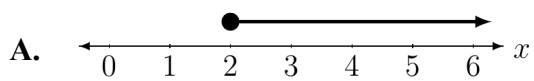
The following information relates to Questions 13 – 14.

A composite solid is made by removing a cylinder from a rectangular prism.
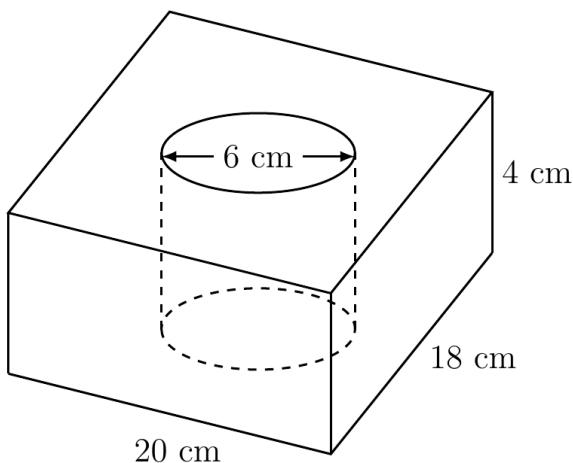
Question 13
The volume of the composite solid is closest to
A. 113.1 cm^3
B. 331.7 cm^3
C. 987.6 cm^3
D. $1{,}326.9 \text{ cm}^3$
E. $1{,}440 \text{ cm}^3$

Question 14
The surface area of the composite solid, including the bottom face and the curved face in the middle, is
A. 75.4 cm^2
B. 331.7 cm^2
C. 635.7 cm^2
D. 967.5 cm^2
E. $1{,}042.8 \text{ cm}^2$

Question 15
Which one of the following statements is **false** about the parabola with equation $y = k(x + 1)^2 - 3$, where k is a constant?
A. The parabola has x-intercepts for all values of k
B. The vertex of the parabola is at $(-1, -3)$
C. If $k > 3$, the y-intercept is always greater than 0
D. The y-intercept is $k - 3$
E. If $k < 0$, the equation describes a negative parabola

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 personal loan of $12,000 is borrowed to finance a home renovation at the interest rate of $r\%$ p.a. compounding monthly. No repayments are made in the first two years.
The following table shows the statement of this loan for the first three months.

Month	Starting Balance	Interest	Closing Balance
1	$12,000.00	$120.00	$12,120.00
2	$12,120.00	$121.20	$12,241.20
3	$12,241.20		

a. Use the first row of the table to show that $r = 12$.   1 mark

_____

_____

b. Find the value of the loan after three months.   2 marks

_____

_____

_____

c. Find the total interest incurred after two years.   2 marks

_____

_____

_____

Question 4 (5 marks)

Sammi is standing at point *S* on the roof of a small building that is 10 m tall, observing a large building nearby. The angle of elevation from *S* to the top of the large building, *T*, is 54°. The angle of depression from *S* to the bottom of the large building, *B*, is 25°.
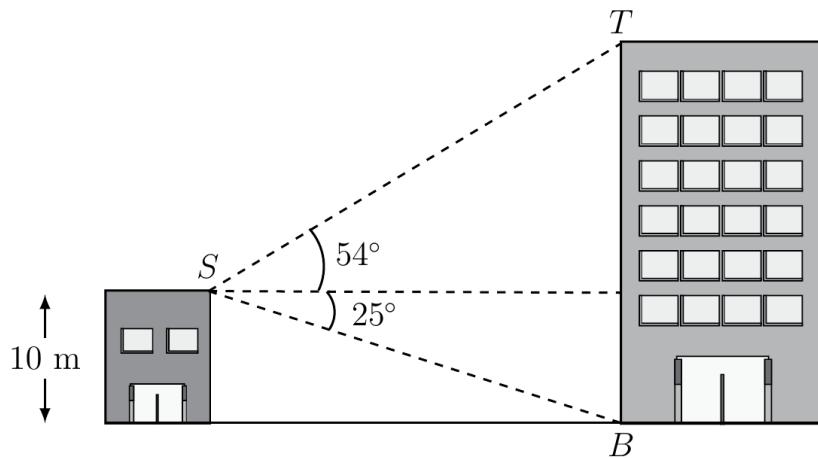
a. Find an expression for the horizontal distance between the small building and the large building.   2 marks

_____

_____

b. Use your answer in part **a** to find the height of the large building is in centimetres.   3 marks
Round your answer to the nearest whole number.

_____

_____

_____

_____

_____

SECTION B - Continued

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)
A local gym offers two options for their customers.

> **Option 1** *Pay a fixed amount of $20 per month, then pay $6 per visit*
>
> **Option 2** *Pay a fixed amount of $30 per month, then pay $4 per visit*

Let n be the number of visits made in a month by a particular customer and C be the total monthly fee they paid.

a. Write a pair of simultaneous equations using the information given.   2 marks

_____

_____

b. Solve the pair of simultaneous equations in part **a** to find the number of visits for which both of the options cost the same amount.   3 marks

_____

_____

_____

_____

c. Find the range of values of n for which the monthly fee of **Option 1** costs more than that of **Option 2**.   1 mark

_____

2022 YEAR 10 (5.2) MATHEMATICS MIDYEAR TEST

SOLUTIONS

SECTION A

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

Question 1

$$3(4x-5)(4x+5) = 3(16x^2-25)$$
$$= 48x^2 - 75$$

Answer is **B**.

Question 2

Subtracting $3x + y = 11$ from $3x - 2y = -4$ gives
$$3x - 2y - (3x + y) = -4 - 11$$
$$-3y = -15$$
$$y = 5$$

Substituting $y = 5$ into either equation gives $x = 2$.

Answer is **A**.

Question 2 (10 marks)

a.   2 marks

The two triangles shown in the cross-section diagram are similar. (A1)

$$\frac{1}{3} \times r = \frac{r}{3} \text{ cm} \quad \text{(A1)}$$

b.   2 marks

The volume of the water is

$$\frac{1}{3} \times \pi \times \left(\frac{r}{3}\right)^2 \times \frac{h}{3} \quad \text{(A1)}$$

$$= \frac{\pi r^2 h}{81} \text{ cm}^3 \quad \text{(A1)}$$

c.   2 marks

$$\frac{\pi r^2 h}{81} : \frac{\pi r^2 h}{3} \quad \text{(A1)}$$

$$= 1 : 27 \quad \text{(A1)}$$

● Accept $1^3 : 3^3 = 1 : 27$.

d.

i.   2 marks

$$\frac{\pi r^2 h}{81} : \left(\frac{\pi r^2 h}{3} - \frac{\pi r^2 h}{81}\right) \quad \text{(A1)}$$

$$= \frac{\pi r^2 h}{81} : \frac{26 \pi r^2 h}{81}$$

$$= 1 : 26 \quad \text{(A1)}$$

● Accept $1 : (27 - 1) = 1 : 26$.

ii.   2 marks

Let t be the time taken to fill the remaining part of the container.

$$1 : 26 = 30 : t \quad \text{(A1)}$$

$$t = 30 \times 26$$

$$= 780 \text{ seconds} \quad \text{(A1)}$$

● Accept 13 minutes.

Question 1 (12 marks)

a. Simplify $\sqrt{81} + \sqrt{25}$. 						2 marks

_____

_____

b. Show that $\sqrt{3^2 + 4^2}$ is not equal to 7. 				2 marks

_____

_____

c. Simplify $\dfrac{\sqrt{5}}{\sqrt{6}} \times \sqrt{42}$. 						2 marks

_____

_____

_____

d. Express $6 - \sqrt{2}$ as a sum of a positive integer and an irrational number between 0 and 1. 		3 marks

_____

_____

_____

_____

Question 2 (8 marks)

a.   1 mark

a^{2mn} (A1)

b.   2 marks

$y^{\frac{3}{4}} \times y^{\frac{5}{4}} = y^{\frac{3}{4}+\frac{5}{4}}$ (A1)

$\qquad\qquad = y^2$ (A1)

c.   2 marks

$5\sqrt[3]{25} = 5 \times 5^{\frac{2}{3}}$ (A1)

$\qquad\quad = 5^{\frac{5}{3}}$ (A1)

d.   3 marks

$3^{-5x-8} = 3^2$ (A1)

$-5x - 8 = 2$ (A1)

$\quad -5x = 10$

$\qquad x = -2$ (A1)

2022 Year 10 (5.3) Mathematics
Expressions, Equations and Linear Relationships Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (11 marks)

a. Write $\dfrac{3}{x+2} - \dfrac{x}{(x+2)^2}$ as a single fraction.   2 marks

_____

_____

_____

_____

b. Rearrange the equation $\dfrac{1}{p^2} + q = r$ to make p the subject.   2 marks

_____

_____

_____

_____

c. Solve the equation $\dfrac{3}{5}x + \dfrac{2}{3} = \dfrac{1}{3}x + \dfrac{6}{5}$.   3 marks

_____

_____

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_____

_____

_____

Question 2 (9 marks)

The diagram shows two straight lines, *l* and *m*, that both pass through the point (4, –1).

The line segment *PQ* is horizontal.

The equation of line *m* is $y = -\dfrac{1}{2}x + 1$.
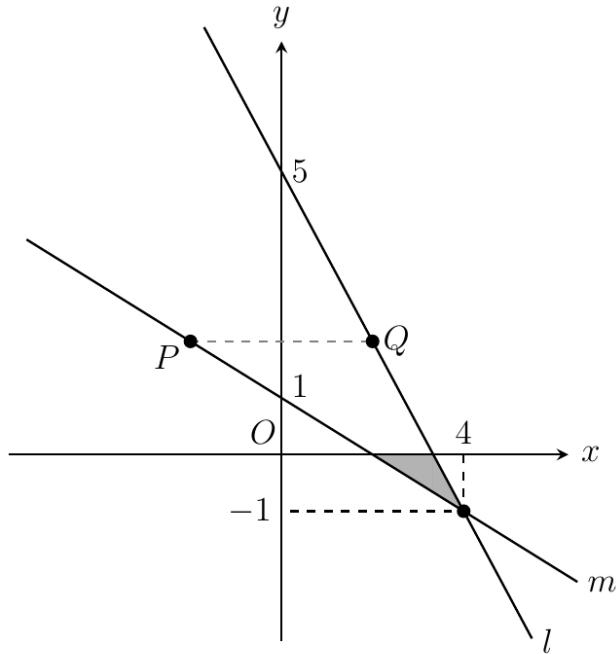
a. Find the equation of line *l*.   2 marks

_____

_____

_____

b. The shaded region in the diagram is enclosed by the *x*-axis, *l* and *m*.   3 marks
   Find the perimeter of the shaded region, expressing your answer in surd form.

_____

_____

_____

_____

_____

d.   **4 marks**

Let t be the number of minutes after Kathy leaves school.

Since *distance = speed × time*

$$2\left(\frac{40}{60}+t\right)=7t \quad \text{(A1)}$$

$$\frac{4}{3}+2t=7t$$

$$-5t=-\frac{4}{3} \quad \text{(A1)}$$

$$t=\frac{4}{15} \text{ hours} \quad \text{(A1)}$$

Therefore, Jenny and Kathy meet after $4/15 \times 60 = 16$ minutes. (A1)

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (9 marks)
Consider the sphere shown below.
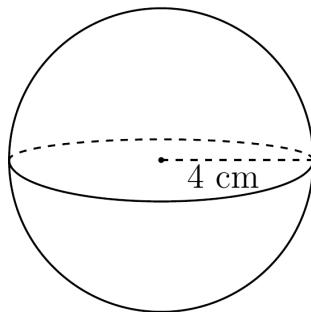
a. Find the volume of the sphere.   2 marks
    Write your answer as an improper fraction in terms of π.

_____

_____

_____

b. The volume of the sphere is equal to the volume of a cylinder with a base radius of 4 cm.   2 marks
    Find the height of the cylinder.
    Round your answer to one decimal place.

_____

_____

_____

_____

_____

c. One eighth of the sphere is removed as shown below.
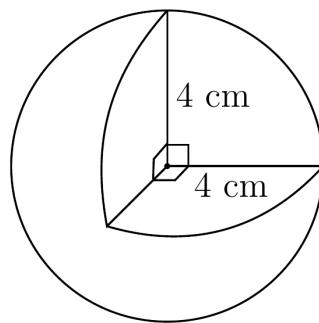
    i. Find the volume of the remaining part of the sphere.   2 marks
       Write your answer as an improper fraction in terms of π.

_____

_____

_____

_____

   ii. Find the surface area of the remaining part of the sphere.   3 marks
       Write your answer in terms of π.

_____

_____

_____

_____

Question 2 (11 marks)
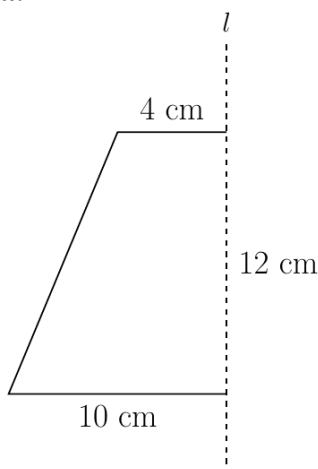
a.   2 marks

- Correct shape is sketched on either side of the line l. (A1)
- The drawn shape is labelled with the correct lengths. (A1)

b.   3 marks

Consider the right half of the cross-section of the truncated cone (which is a right-angled triangle).
By similarity

$$\frac{x}{12+x} = \frac{4}{10} \quad \text{(A1)}$$

$$10x = 48 + 4x \quad \text{(A1)}$$

$$6x = 48$$

$$x = 8 \quad \text{(A1)}$$

c.   3 marks

$$\frac{1}{3} \times \pi \times 10^2 \times 20 - \frac{1}{3} \times \pi \times 4^2 \times 8 \quad \text{(A1)} \times 2$$

$$= 624\pi \ \text{cm}^3 \quad \text{(A1)}$$

d.   3 marks
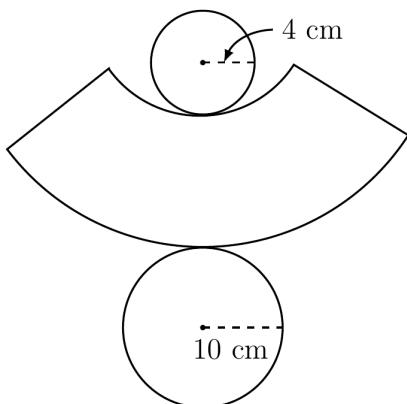
- Correct two circular faces are drawn. (A1)
- Correct curved side is drawn. (A1)
- Correct measurements. (A1)

2022 Year 10 (5.3) Mathematics
Quadratic Expressions, Quadratic Equations and Parabolas Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (14 marks)

a. Factorise $3x^2 - 6x - 24$. 2 marks

b. Use part **a** to factorise $3x^4 - 6x^2 - 24$. 2 marks

c. Solve the equation $(x + 9)^2 = 16$. 3 marks

d. Show that the equation $2x^2 - 3x + 5 = 0$ has no real solutions. 2 marks

Question 2 (11 marks)

A rectangle is inscribed inside the region enclosed by the parabola and the x-axis as shown below. It is given that $a > 0$.
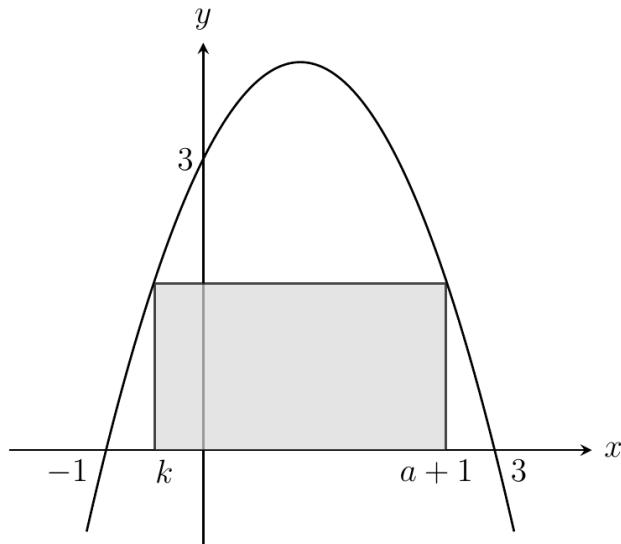
a. Find the equation of the parabola in the form $y = -(x + p)(x + q)$, where p and q are integers.   2 marks

_____

_____

b. i. Find the maximum value of y and the value of x at which the maximum occurs.   3 marks

_____

_____

_____

_____

ii. Show that $k = 1 - a$.   2 marks

_____

_____

_____

2022 Year 10 (5.3) Mathematics
Quadratic Expressions, Quadratic Equations and Parabolas Test
Total marks: 25 marks

Question 1 (14 marks)
a.   2 marks

$3x^2 - 6x - 24 = 3(x^2 - 2x - 8)$ (A1)

$\qquad\qquad = 3(x - 4)(x + 2)$ (A1)

b.   2 marks

$3x^4 - 6x - 24 = 3(x^2 - 4)(x^2 + 2)$ (A1)

$\qquad\qquad = 3(x - 2)(x + 2)(x^2 + 2)$ (A1)

● The results of part **a** ($3x^2 - 6x - 24 = 3(x - 4)(x + 2)$) is applied to the first line.
● Allow using substitution such as $u = x^2$.

c.   3 marks

$(x + 9)^2 = 16$

$\quad x + 9 = \pm 4$ (A1)

$\qquad x = -9 \pm 4$

$\qquad x = -13, \ -5$ (A1)×2

● Award expanding LHS.

d.   2 marks

$D = (-3)^2 - 4 \times 2 \times 5 = -31$ (A1)

Since $D < 0$, the quadratic equation has no real solutions.   (A1)

e.
i.   1 mark

Equating the expressions for the bottom edge and top edge gives
$2l + 2 = 4w$

$\quad l = 2w - 1$

● Correct working is shown.   (A1)

ii.   4 marks

Since the area of the floor is 408 cm^2

$\quad 4w \times (w + l) = 408$ (A1)

$4w \times (w + 2w - 1) = 408$

$12w^2 - 4w - 408 = 0$

$\quad 3w^2 - w - 102 = 0$

$(3w + 17)(w - 6) = 0$ (A1)

$\qquad\qquad w = 6$ (A1)

Therefore, $A = w \times l = 6 \times 11 = 66$ cm^2.   (A1)

● Accept using an equivalent equation $6wl + 2w = 408$.

2022 Year 10 (5.3) Mathematics
Trigonometry Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (10 marks)

a. Determine the smallest positive solution to the equation $\cos(x) = 0.5$.   1 mark

_____

_____

b. Complete the table below by writing down the appropriate symbols or numbers.   2 marks

θ	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$
0°	0		0
	$\dfrac{1}{\sqrt{2}}$	$\dfrac{\sqrt{2}}{2}$	1

c. If $\tan(t) = -\dfrac{1}{\sqrt{5}}$ and $\cos(t) = -\dfrac{\sqrt{5}}{\sqrt{6}}$, where $90° < t < 180°$, find the exact value of $\sin(t)$.   2 marks

_____

_____

_____

_____

Question 2 (8 marks)

a. Sketch the graph of $y = \tan(x)$ for $-180° \leq x \leq 180°$ on the set of axes below.   3 marks
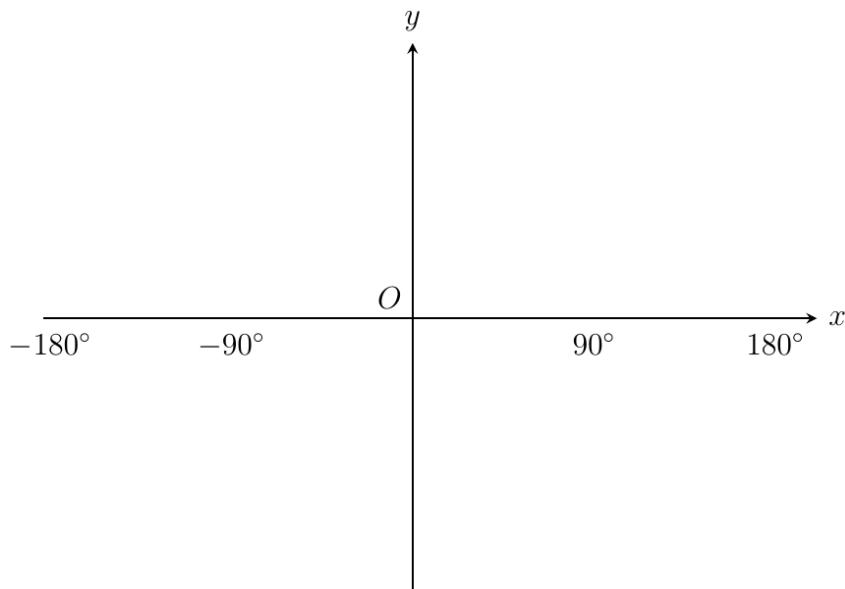
b. Solve the equation $\tan(x) = -0.45$ for $-180° \leq x \leq 180°$.   2 marks
    Round your answers to one decimal place.

_____

_____

_____

c. Determine whether the following statements are true or false.

   i. The period of the sine graph $y = \sin(x)$ is 180º.   1 mark

           True   False

   ii. The cosine graph $y = \cos(x)$ is symmetric about the y-axis.   1 mark

           True   False

   iii. The tangent graph $y = \tan(x)$ passes through the point $(1°, 45)$.   1 mark

           True   False

2022 Year 10 (5.3) Mathematics
Trigonometry Test
Total marks: 25 marks

Question 1 (10 marks)
a. 1 mark

$x = 60°$ (A1)

b. 2 marks

θ	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$
0°	0	1 (A1)	0
45° (A1)	$\dfrac{1}{\sqrt{2}}$	$\dfrac{\sqrt{2}}{2}$	1

c. 2 marks

$\sin(t) = \tan(t)\cos(t)$ (A1)

$$= \left(-\frac{1}{\sqrt{5}}\right) \times \left(-\frac{\sqrt{5}}{\sqrt{6}}\right)$$

$$= \frac{1}{\sqrt{6}} \quad \text{(A1)}$$

d.
i. 1 mark

$\cos(\theta) = \dfrac{x}{1} = x$ (A1)

ii. 2 marks

$\cos(-\theta) = \cos(\theta)$ (A1)

$\qquad = x$ (A1)

iii. 2 marks

$\tan(-\theta) = -\tan(\theta)$ (A1)

$$= -\frac{y}{x} \quad \text{(A1)}$$

Time allowed: 1 hour
Total marks: 20 marks

In each question, ensure your responses are supported with geometric reasoning.

Question 1 (9 marks)

a. In the circle below with centre O, $\angle OAB = a°$. 6 marks
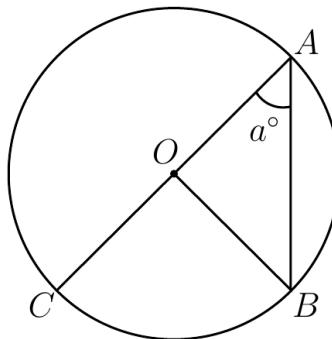
Show that $\angle BOC = 2a°$ using two different proofs.

First proof:

_____

_____

_____

_____

_____

_____

Second proof:

_____

_____

_____

_____

_____

_____

b. In the parallelogram below, diagonal *AC* bisects angle *BAD*.   3 marks
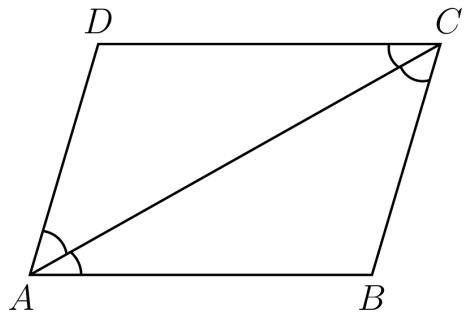
Show that diagonal *AC* also bisects angle *BCD*.

_____

_____

_____

_____

_____

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_____

Question 3 (6 marks)

a.   2 marks
Since $WP \times PX = YP \times PZ$ (A1)

$12 \times 16 = YP \times 24$, which simplifies to $YP = 8$. (A1)

b.   4 marks
Let OM and ON be perpendicular to chords WX and YZ respectively.
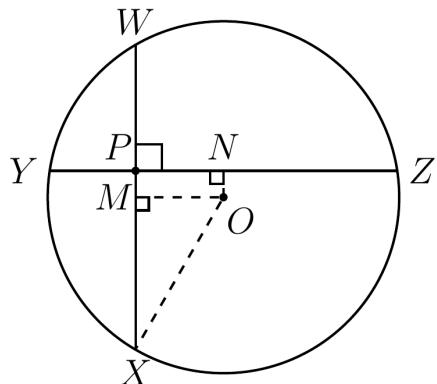
Since the perpendicular from the centre of a circle to a chord bisects the chord (A1)

$$WM = XM = \frac{12+16}{2} = 14$$

$$YN = ZN = \frac{8+24}{2} = 16$$

● Correct WM and YN are found. (A1)

$OM = NP = YN - YP = 16 - 8 = 8$. (A1)

OX is a radius of the circle. Since OMX is a right-angled triangle, by Pythagoras' theorem
$OX^2 = OM^2 + XM^2 = 8^2 + 14^2 = 260$. (A1)

2022 Year 10 (5.3) Mathematics
Non-linear Relationships, Functions and Their Graphs Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (11 marks)

a.   2 marks
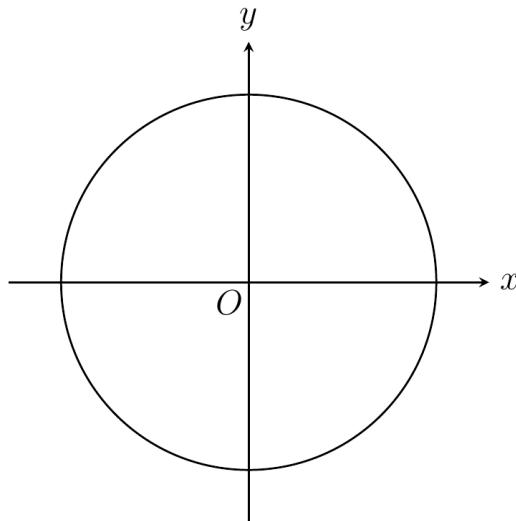
Apply the vertical line test to the graph shown above and state your conclusion with justification.

_____

_____

b. Consider the function $h(x) = 5^{-x} + 1$.

   i. Find the domain of h.   1 mark

_____

   ii. Find the range of h.   1 mark

_____

_____

c. A function $g(x)$ satisfies the property $g(-x) = g(x)$.   1 mark
   Write down a possible rule for $g(x)$.

_____

Question 2 (7 marks)

a. The following graph shows the distance of a truck from the factory with respect to time.
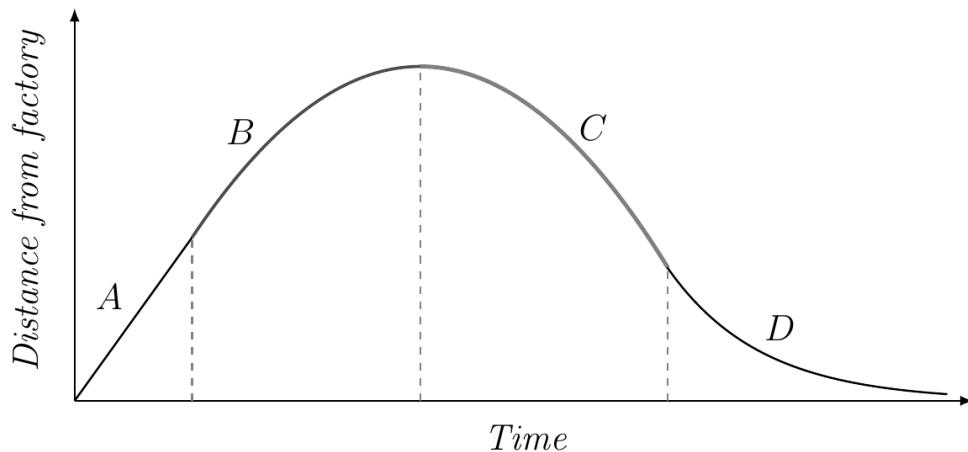
For each segment (*A*, *B*, *C* and *D*), describe how the gradient and speed are varying.

i. Segment *A*   1 mark

_____

ii. Segment *B*   1 mark

_____

iii. Segment *C*   1 mark

_____

iv. Segment *D*.   1 mark

_____

b. It is given that x and y are inversely proportional and $y = 0.8$ when $x = 5$.   3 marks
Find the rule for y in terms of x.

_____

_____

_____

_____

Question 3 (7 marks)

a.   1 mark

All real numbers except for $x = 1$. (A1)

b.   1 mark

$y = \dfrac{2}{0-1} = -2$ (A1)

c.   2 marks

$\dfrac{2}{x-1} = 2$ (A1)

$\dfrac{x-1}{2} = \dfrac{1}{2}$

$\quad x = 2$ (A1)

d.   3 marks
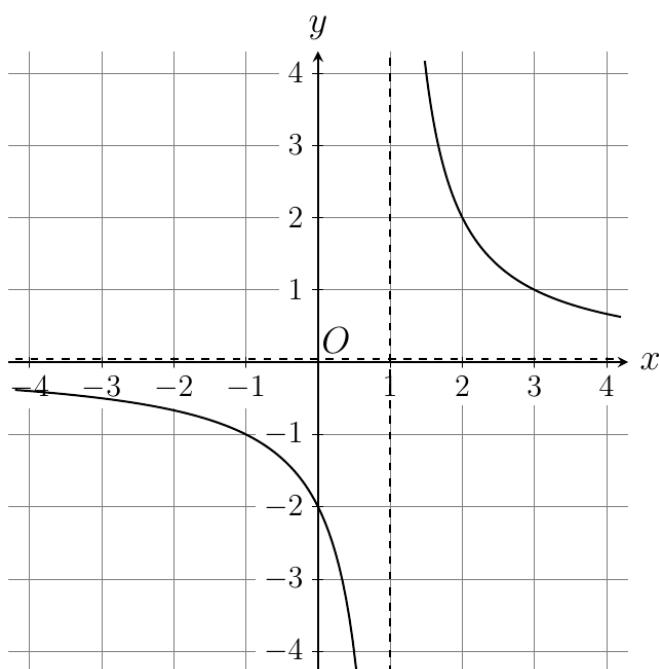
● Correct shape. (A1)
● Correct y-intercept (-2). (A1)
● Sketched dotted lines for the vertical asymptote ($x = 1$) and the vertical asymptote ($y = 0$). (A1)

2022 Year 10 (5.3) Mathematics
Logarithms and Polynomials Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (11 marks)

a. Write down the degree of a quartic polynomial.   1 mark

_____

b. It is given that $x^3 + x^2 - 2x - 2 = (x + 1)(x^2 + p)$, where p is an integer.

   i. Find the value of p.   2 marks

_____

_____

_____

_____

   ii. Explain why $(x + 1)$ is a factor of $x^3 + x^2 - 2x - 2$.   1 mark

_____

_____

c. Determine the remainder when $Q(x) = x^3 + 3x^2 + 4$ is divided by $(x - 1)$.   2 marks

_____

_____

_____

_____

Question 2 (9 marks)

a. Simplify $\log_3(3) + \log_3(9)$.   2 marks

b. Simplify $\log_{10}\left(\dfrac{1}{10^5}\right)$.   2 marks

c. Solve $\log_{25}(625) = x$.   2 marks

d. A smartphone initially purchased for $2,000 depreciates in value by 20% each month.   3 marks
After how many months will the value of the smartphone reduce to $819.20?

2022 Year 10 (5.3) Mathematics
Logarithms and Polynomials Test
Total marks: 25 marks

Question 1 (11 marks)
a.   1 mark
4 (A1)

b.
i.   2 marks
$(x + 1)(x^2 + p) = x^3 + x^2 + px + p$ (A1)

Comparing LHS and RHS terms gives $p = -2$. (A1)

● Accept any other valid method.

ii.   1 mark
$(x + 1)$ is a factor since $x^3 + x^2 - 2x - 2 = (x + 1)(x^2 - 2)$ is divisible by $(x + 1)$. (A1)

● Accept using the factor theorem.

c.   2 marks
$Q(1) = 1^3 + 3(1)^2 + 4 = 8$. (A1)

By the remainder theorem, the remainder of $Q(x)$ upon division by $(x - 1)$ is 8. (A1)

d.
i.   2 marks
Since $x = 5$ is an x-intercept of the graph, $(5)^3 - 6(5)^2 + 3(5) + 10 = 0$. (A1)
By the factor theorem, $(x - 5)$ is a factor of $x^3 - 6x^2 + 3x + 10$. (A1)

ii.   3 marks
Dividing $x^3 - 6x^2 + 3x + 10$ by $(x - 5)$ and then factorising gives

$x^3 - 6x^2 + 3x + 10 = (x - 5)(x^2 - x - 2) = (x - 5)(x + 1)(x - 2)$ (A1)

Therefore, the other x-intercepts of the (cubic) graph are $x = -1$ and $x = 2$. (A1)×2

● Accept other valid methods such as guessing the other factors of $x^3 - 6x^2 + 3x + 10$.

2022 Year 10 (5.3) Mathematics
Single Variable and Bivariate Statistics Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (9 marks)
The following data shows the amount five households paid for their power bill in January 2021.

$97 $121 $88 $112 $92

The mean amount of the power bills is $102.

a. Calculate the standard deviation of the data.   2 marks
   Round your answer to the nearest cent.

_____

_____

_____

b. Describe how each of the following would change the standard deviation.

   i. Each power bill for the five households is discounted by $10.   1 mark

_____

   ii. Another household that paid $150 is added to the data.   1 mark

_____

c. Suppose that the power bills paid by the households in July 2021 are also considered.
   The mean amount of the power bills in July is $178 and the standard deviation is $20.

   i. State a possible reason why the mean of power bills paid in July is greater than that for January. 1 mark

_____

_____

   ii. Compare the standard deviation for July to that for January.   2 marks

_____

_____

Question 2 (11 marks)

A professional tiler records the *area of floor*, in m², and the *time taken* to lay tiles on the floor, in hours, for 11 bathrooms. The results are shown in the table below.

Area of floor (m²)	5	6	6.2	7.2	7	7.8	11.6	10	12.8	13.1	13.5
Time taken (hours)	8	10	14	12	16	20	20	21	24	26	28

The scatter plot of this bivariate data is shown below.
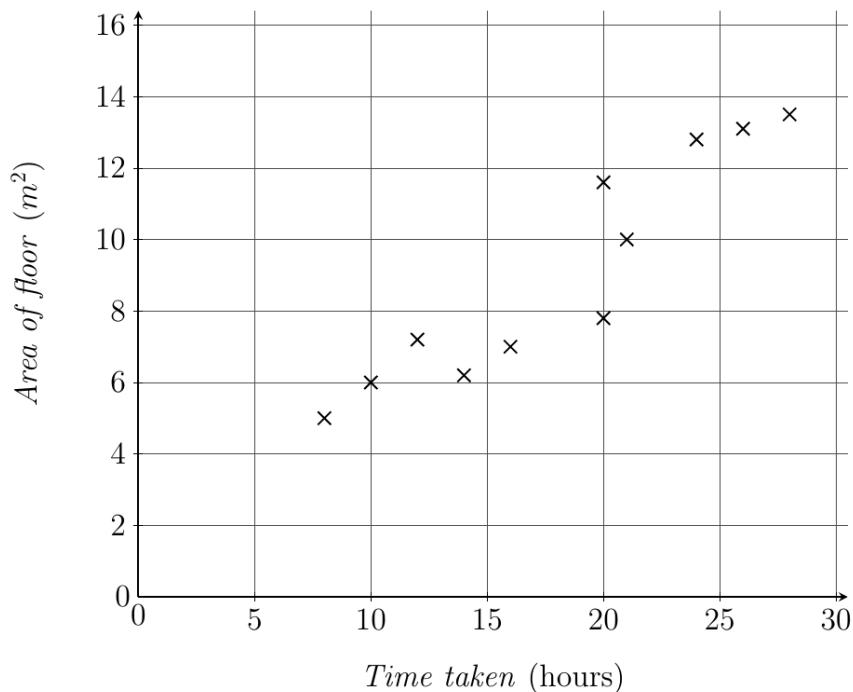
a. Describe the correlation between *area of floor* and *time taken* in terms of direction and strength.   2 marks

_____

_____

b. Use a CAS to find the equation of the least squares regression line.   2 marks
   Round the coefficients to four decimal places.

_____

_____

c. Sketch the graph of the regression line onto the scatter plot.   2 marks

2022 Year 10 (5.3) Mathematics
Single Variable and Bivariate Statistics Test
Total marks: 20 marks

Question 1 (9 marks)
a.   2 marks

$$\sqrt{\frac{(97-102)^2+(121-102)^2+...+(92-102)^2}{5}}$$

$$\approx \$12.51$$

If the sample standard deviation is taught in class, accept the following.

$$\sqrt{\frac{(97-102)^2+(121-102)^2+...+(92-102)^2}{5-1}}$$

$$\approx \$13.98$$

● Correct working is shown. (A1)
● Correct answer is found. (A1)

b.
i.   1 mark
No change (A1)

ii.   1 mark
The standard deviation would increase. (A1)

c.
i.   1 mark
Power bills are more expensive in winter in general. (A1)

ii.   2 marks
Since the standard deviation of the July data is greater than that of the January data (A1)
the power bills in July are more spread out from the mean compared to those in January. (A1)

d.
i.   1 mark
When there are no outliers. (A1)

ii.   1 mark
Where there are outliers. (A1)

2022 YEAR 10 (5.3) MATHEMATICS
MIDYEAR TEST

Reading time: 15 minutes
Writing time: 2 hours

QUESTION BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of marks
A	15	15	15
B	5	5	25
C	2	2	20
			Total 60

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.

Question 1
Factorising $3x^2 - x - 2$ gives
A. $(3x - 2)(x - 1)$
B. $(3x + 2)(x - 1)$
C. $(3x + 2)(x + 1)$
D. $(3x - 2)(x + 1)$
E. $-(3x - 2)(x - 1)$

Question 2
$\dfrac{1}{\sqrt{5} + 2}$ is equal to

A. $-\sqrt{2} + 5$
B. $\sqrt{2} + 5$
C. $\sqrt{5} + 2$
D. $\sqrt{5} - 2$
E. $\dfrac{1}{\sqrt{5} - 2}$

Question 3
The solution to the equation $\log_7(49) = x$ is
A. 0.5
B. 1
C. 2
D. 2.5
E. 7^{49}

Question 8

The domain and range of the function $f(x) = \dfrac{x+4}{x+1}$ are respectively

	Domain	**Range**
A.	all real numbers except for $x = 1$	all real numbers
B.	all real numbers	all real numbers
C.	all real numbers except for $x = -1$	all real numbers except for $y = -4$
D.	all real numbers	all real numbers except for $y = 1$
E.	all real numbers except for $x = -1$	all real numbers except for $y = 1$

Question 9

$(x + 2)$ and $(x - 3)$ are factors of the polynomial $p(x) = x^3 + px^2 + qx + 6$.
The values of the constants p and q are respectively

A. $p = -2, q = -5$

B. $p = 2, q = -5$

C. $p = 2, q = 5$

D. $p = 2, q = -3$

E. $p = -5, q = -2$

SECTION B

<table>
<tr><td align="center">Instructions for Section B</td></tr>
</table>

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)

The width of a rectangle is equal to the side length of one square and the length of the rectangle is equal to the side length of another square. The areas of the squares are 72 cm^2 and 162 cm^2.

a. Find the perimeter of the smaller square.   2 marks
   Write your answer in surd form.

_____

_____

_____

b. Find the area of the rectangle.   3 marks

_____

_____

_____

_____

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Question 4 (5 marks)

A composite shape is rotated about a vertical line, l, forming a composite solid.
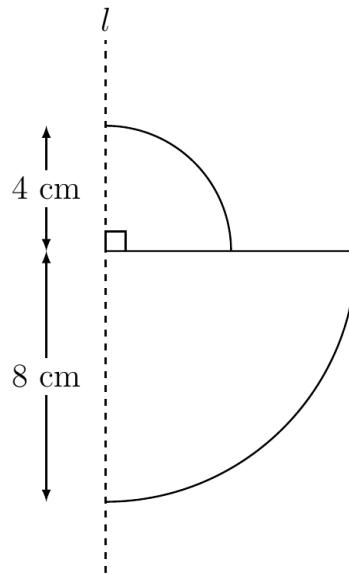
a. Find the volume of the composite solid.   2 marks
   Write your answer in terms of π.

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b. Find the surface area of the composite solid.   3 marks
   Write your answer in terms of π.

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SECTION B - Continued

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)

When Damian works on a data entry task by himself, he takes 24 minutes longer to complete the task than
Eryn. If Damian and Eryn work on the task together, they will complete it in 16 minutes.

Let t be the time taken, in minutes, by Damian to finish the task himself.

a. i. Explain why the equation $\dfrac{1}{\dfrac{1}{t} + \dfrac{1}{t-24}} = 16$ represents information given above.   1 mark

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  ii. Show that the equation $t^2 - 56t + 384 = 0$.   3 marks

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b. Use the discriminant ($D = b^2 - 4ac$) to show $t^2 - 56t + 384 = 0$ has two (real) solutions.   1 mark

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2022 YEAR 10 (5.3) MATHEMATICS MIDYEAR TEST

SOLUTIONS

SECTION A

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

Question 1

$3x^2 - x - 2 = (3x + 2)(x - 1)$

Answer is **B**.

Question 2

$$\frac{1}{\sqrt{5}+2} = \frac{1}{\sqrt{5}+2} \times \frac{\sqrt{5}-2}{\sqrt{5}-2}$$

$$= \frac{\sqrt{5}-2}{5-4}$$

$$= \sqrt{5}-2$$

Multiplying by $\dfrac{-\sqrt{5}+2}{-\sqrt{5}+2}$ gives the same results.

Answer is **D**.

Question 2 (10 marks)

a.   1 mark

$t \geq 0$ (A1)

b.   2 marks

$$T(t) = \frac{5t + 250}{t + 10}$$

$$= \frac{5(t + 10) + 200}{t + 10} \quad \text{(A1)}$$

$$= 5 + \frac{200}{t + 10} \quad \text{(A1)}$$

● Accept performing a long division.

c.   4 marks
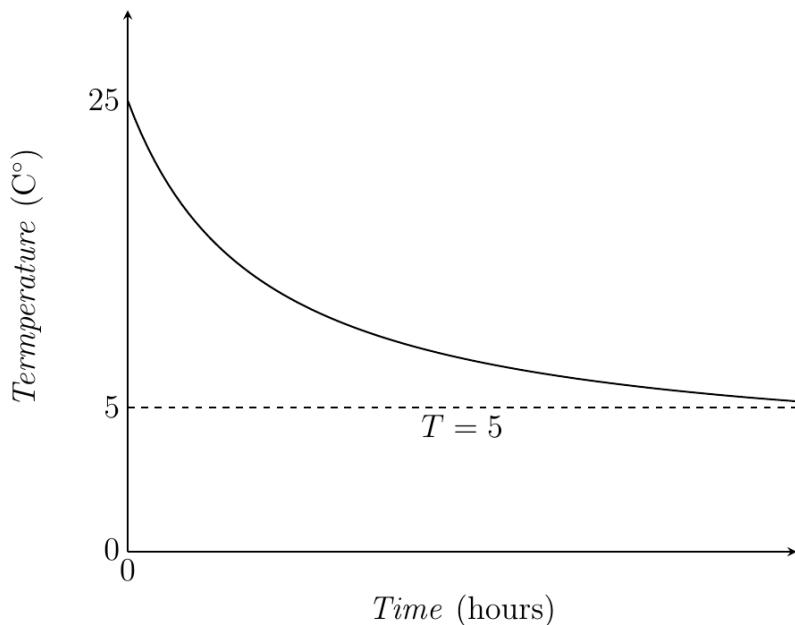
● Correct hyperbola is sketched. (A1)
● Correct horizontal asymptote is sketched (dotted line) (A1)
● Horizontal asymptote is sketched and labelled with the correct equation ($T = 5$). (A1)
● The correct vertical intercept is indicated (25). (A1)

d.   1 mark

The temperature inside the room reduces very close to 5 ºC. (A1)

● Penalise if stated that the temperatures *reduces to 5 ºC*.