2022 Year 10 /10A Topic Tests Information Sheet

2022 Year 10/10A Topic Tests is a set of short answer questions and their solutions.

The topics covered are:

Year 10 topics
- Financial Mathematics (3 questions)
- Indices and Numbers of Any Magnitude (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 1 (2 questions)
- Probability 2 (2 questions)
- Single Variable Statistics (2 questions)
- Single Variable and Bivariate Statistics (2 questions)
- Mid-year Test

Year 10A topics
- 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 Year 10/10A 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

2022 Year 10 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 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 *T*s 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 $\frac{1}{25}$. 2 marks

Question 2 (9 marks)

a. 2 marks

$v = 3.25 \times 0.05$ (A1)

$= 0.1625$ (A1)

b. 1 mark

$0.0095 = 9.5 \times 10^{-3}$ seconds (A1)

c. 1 mark

$1.4 \times 10^3 \div (7.5 \times 10^4) \approx 0.0187$ (A1)

d.

i. 3 marks

Since the number of seconds in a year is $365 \times 24 \times 60 \times 60$ (A1)

the distance Star B and the Sun is

$3.0 \times 10^8 \times 365 \times 24 \times 60 \times 60$ (A1)

$= 9.4608 \times 10^{15}$ m

$= 9.4608 \times 10^{12}$ km (A1)

ii. 2 marks

4.5×30 (A1)

$= 135$ (A1)

2022 Year 10 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 $\frac{20y}{6} \div \frac{4y}{3}$. 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

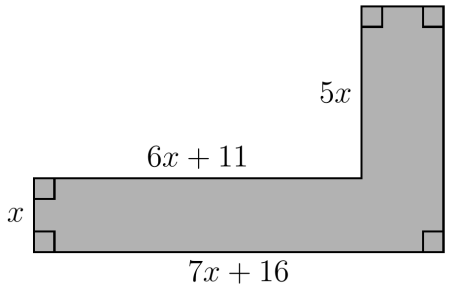
f. When the minute hand of a clock moves by m^o, the hour hand moves h^o. 2 marks
Find h in terms of m, expressing your answer as a fraction in simplest form.

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 six times the positive integer. 2 marks

Find the positive integer.

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



Find the value of x.

Question 3 (10 marks)

a. 2 marks

Let the positive number be p.

$3+4p=6p-7$ (A1)

$-2p=-10$

$p=5$ (A1)

b. 3 marks

$2\times(7x+16)+2\times(5x+x)=84$ (A1)

$14x+32+12x=84$

$26x+32=84$ (A1)

$26x=52$

$x=2$ (A1)

c.

i. 2 marks

$2a+3c=23$ (A1)

$a+c=9.5$ (A1)

ii. 3 marks

Substituting $a=9.5-c$ into $2a+3c=23$ gives

$2(9.5-c)+3c=23$ (A1)

$19-2c+3c=23$ (A1)

$c=4$ (A1)

The cost of a concession ticket is \$4.

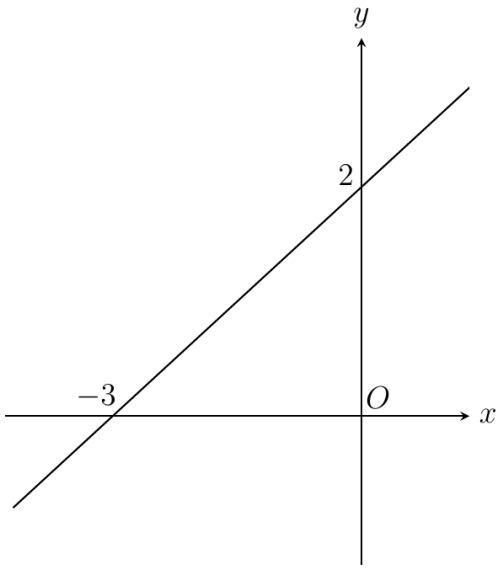
● Accept other valid methods.

2022 Year 10 Mathematics
Linear Relationships Test

Time allowed: 1 hour
Total marks: 20 marks

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. $ax + by + c = 0$).

_____

_____

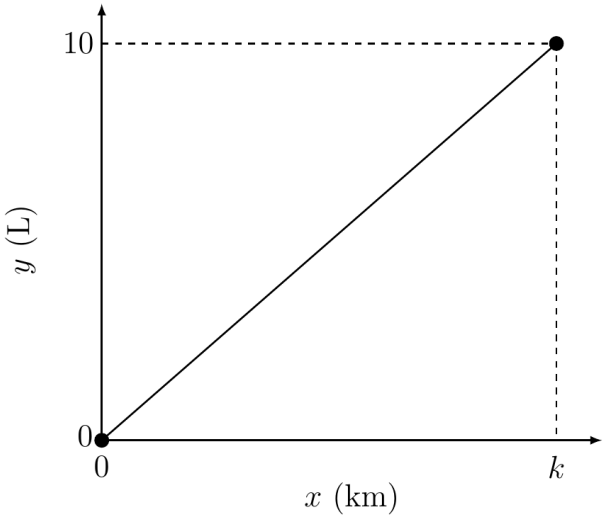
_____

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

Question 2 (9 marks)

a.

i. 1 mark

directly proportional (A1)

ii. 2 marks

$y = \frac{1}{20}x$

● The correct rule is found (A1)×2

iii. 2 marks

$\frac{1}{20}k = 10$ (A1)

$k = 200$ (A1)

iv. 2 marks

The car consumes 10 L of petrol when it travels 200 km. (A1)×2

b. 2 marks

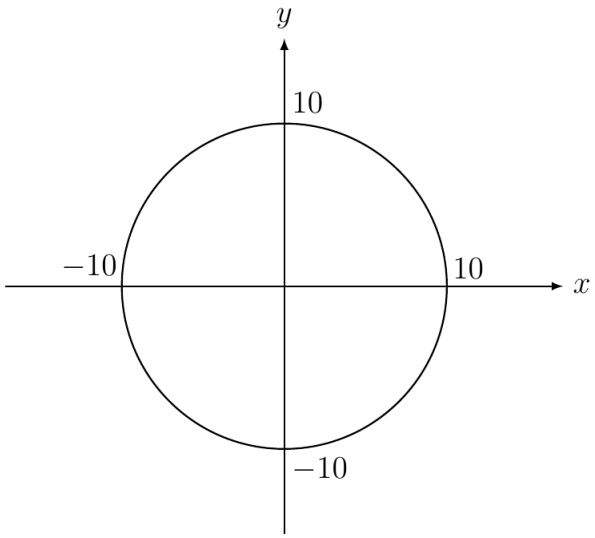
As the number of people involved increases, the time taken to complete the task decreases. (A1)×2

● Also accept "As the number of people involved decreases, the time taken to complete the task increases."

2022 Year 10 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

_____

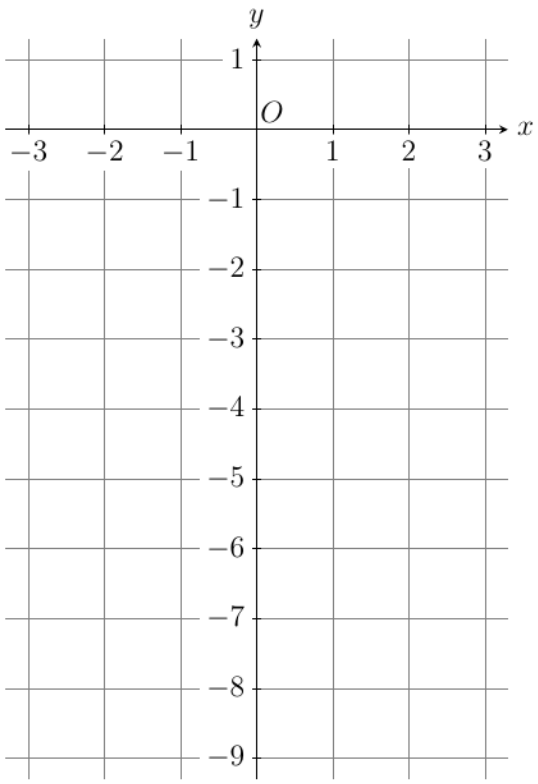
Question 3 (12 marks)

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.

_____

Question 2 (8 marks)

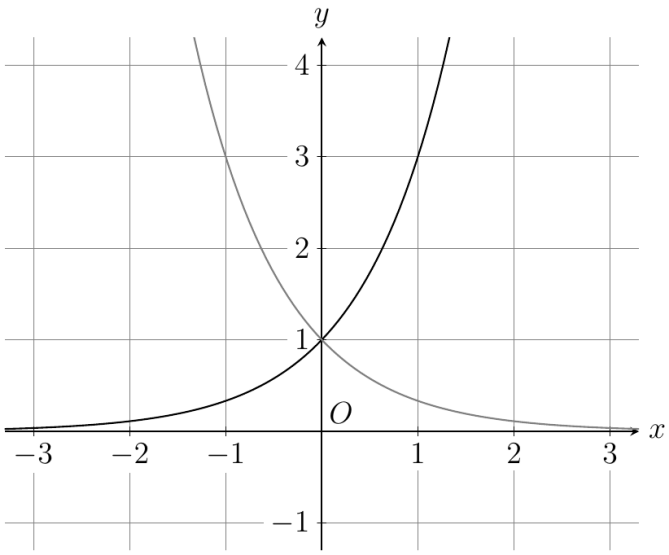
a. 1 mark

Exponential (A1)

b. 1 mark

$y = 0$ (A1)

c. 2 marks



- The two graphs are symmetric about the line $x = 0$. (A1)
- The new graph passes through the point $(0, 1)$ and does not reach below the line $y = 0$. (A1)

d. 2 marks

$y = -3^x$ (A1)×2

e. 2 marks

Similarity
- Both graphs increase exponentially at the same rate.
- Both graphs do not have any x-intercepts.

- One valid similarity. (A1)

Difference
- The graphs have different y-intercepts.
- The graphs have different asymptotes.

- One valid difference. (A1)

b. 4 marks

$(x+4)(x+5) = 20+10$ (A1)

$x^2 + 9x + 20 = 30$

$x^2 + 9x - 10 = 0$ (A1)

$(x+10)(x-1) = 0$

$x = -10,\ 1$ (A1)

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

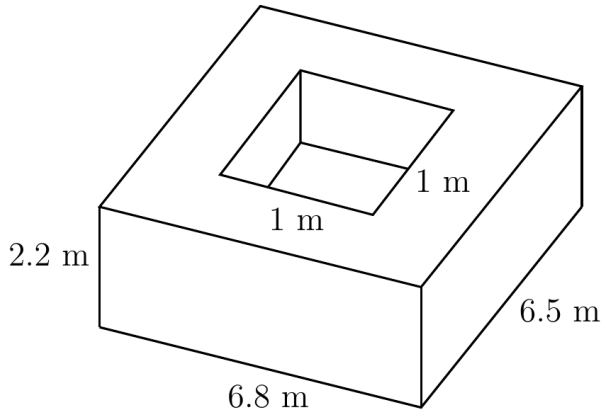
- This justification is not required.

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

2022 Year 10 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.

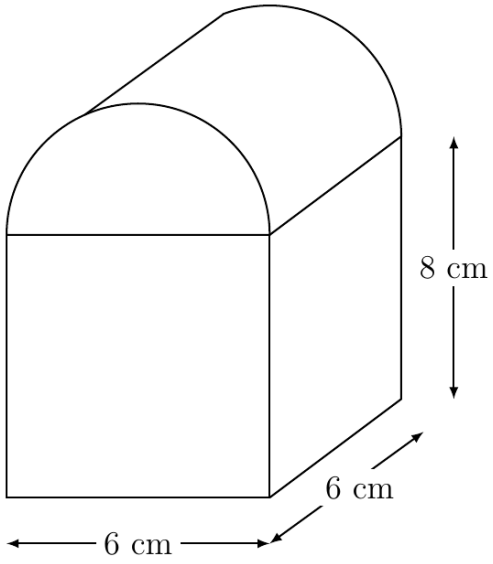


a. Find the area of the cross-section of the solid. 2 marks

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 Mathematics
Measurement Test
Total marks: 20 marks

Question 1 (11 marks)

a. 2 marks

The area of the cross-section is

$6.8\times6.5-1\times1$ (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

$1\times1\times2.2$

$=2.2\ \text{m}^3$

● 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

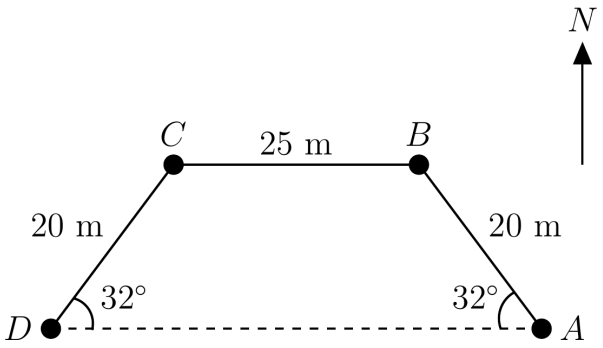
$2\times43.2+2\times6.8\times2.2+2\times6.5\times2.2+4\times1\times2.2$ (A1)×2

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

2022 Year 10 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.



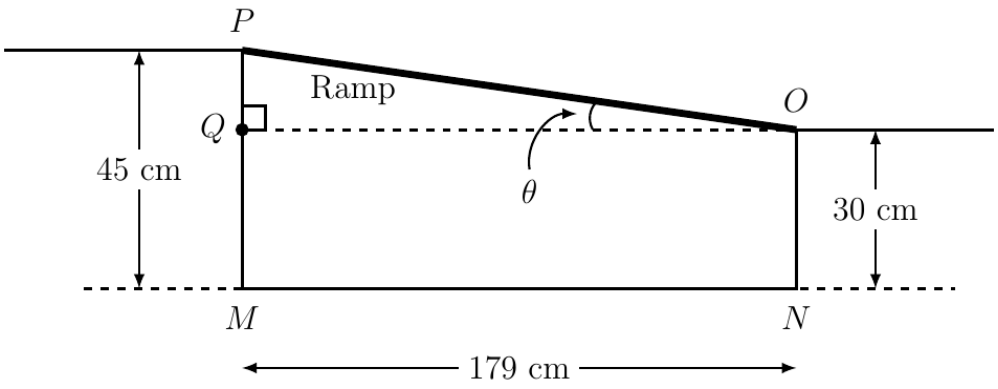
a. Show that the horizontal distance between A and B is given by $20\cos(32^\circ)$. 1 mark

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.

Question 2 (10 marks)
A restaurant has a ramp at the entrance as shown in the diagram below.
The ramp is at an angle of θ to the horizontal.



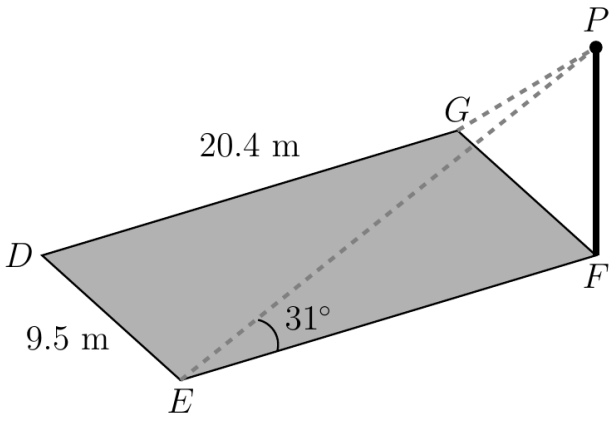
a. Find the length of OP. 2 marks
Round your answer to two decimal places.

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

c. Convert to your answer to part **b** to degrees and minutes, correct to the nearest minute. 1 mark

d. Find the angle of elevation from N to P. 2 marks
Round your answer to one decimal place.

Question 3 (5 marks)
A vertical pole *FP* stands at the corner of a rectangular field *DEFG* as shown in the diagram.
The angle of elevation from corner *E* to the top of the pole *P* is 31º.



Two taut lines are placed from the corners of the field *E* and *G* to the top of the pole *P*.
It is claimed that the combined length of the lines is 40 m.
Determine whether the claim is true or not.

Question 2 (10 marks)

a. 2 marks

The length of OP is

$\sqrt{179^2 + (45-30)^2}$ (A1)

$= \sqrt{32266}$

≈ 179.63 cm (A1)

b. 2 marks

$\tan(\theta) = \frac{15}{179}$ (A1)

$\theta = \tan^{-1}\left(\frac{15}{179}\right)$

$\approx 4.8^\circ$ (A1)

c. 1 mark

4° 48′ (A1)

d. 2 marks

Let the angle MNP be x.

$\tan(x) = \frac{45}{179}$ (A1)

$x = \tan^{-1}\left(\frac{45}{179}\right)$

$\approx 14.1^\circ$ (A1)

e. 3 marks

The angle of depression from P to N is 14.1º. (A1)

The angle of depression from Q to N is

$\tan^{-1}\left(\frac{30}{179}\right) \approx 9.5^\circ$

● Correct working is shown. (A1)

Therefore, the angle of depression from P to N exceeds that from Q to N by

$14.1^\circ - 9.5^\circ \approx 4.6^\circ$ (A1)

2022 Year 10 Mathematics
Geometrical Figures Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (10 marks)

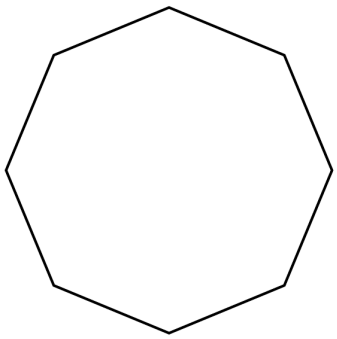
a. A octagon is a polygon with 8 sides.

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



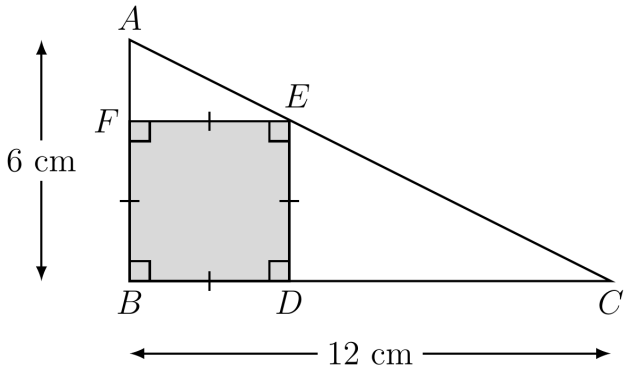
Find the size of an exterior angle of the regular octagon.

_____

_____

_____

Question 2 (8 marks)
Square $BDEF$ is inscribed in a right-angled triangle ABC, where $AB = 6$ cm and $BC = 12$ cm.
Let the side length of square $BDEF$ be x cm.



a. Prove that triangle ABC and triangle AFE are similar. 3 marks

b. Find the value of x. 3 marks

c. Find the ratio of AE to EC. 2 marks

2022 Year 10 Mathematics
Geometrical Figures Test
Total marks: 25 marks

Question 1 (10 marks)

a.

i. 1 mark

$(8-2)\times 180^{\circ} = 1{,}080^{\circ}$ (A1)

ii. 2 marks

The size of an interior angle is

$\frac{1{,}080^{\circ}}{8} = 135^{\circ}$ (A1)

Therefore, the size of an exterior angle is

$180^{\circ} - 135^{\circ} = 45^{\circ}$ (A1)

● Also accept $360^{\circ}/8 = 45^{\circ}$.

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

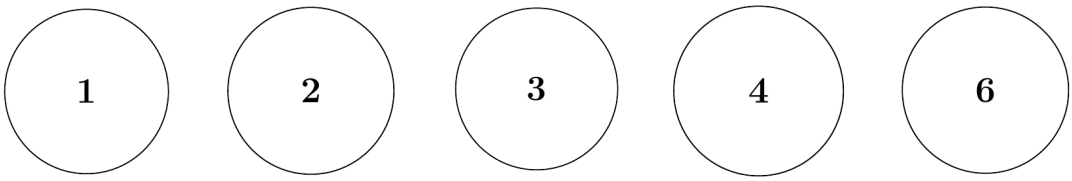
$(5-2)\times 180^{\circ}$ (A1)

$= 540^{\circ}$ (A1)

2022 Year 10 (5.1) Mathematics
Probability 1 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 to be close to each other? 2 marks
Explain your answer.

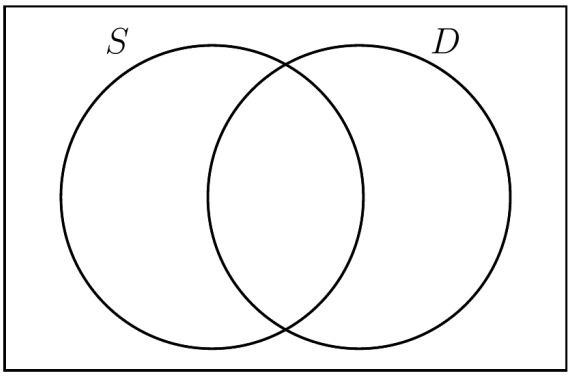
_____

_____

Question 2 (11 marks)
56 people were asked if they can sing (S) or dance (D).
The results were:
• 28 people can sing
• 10 people cannot sing or dance
• 8 people can sing and dance

a. Show that the number people who can dance but cannot sing is 18. 1 mark

b. Complete the following Venn diagram by writing down the appropriate numbers. 3 marks



c. One person is randomly selected.

i. Find the probability that the person can dance but not sing. 2 marks
Write your answer as a fraction in simplest form.

ii. Find the probability that the person can sing or dance but not both. 2 marks
Write your answer as a fraction in simplest form.

d. Explain why the events "a person can sing" and "a person can dance" are not mutually exclusive. 1 mark

2022 Year 10 Mathematics
Probability 1 Test
Total marks: 20 marks

Question 1 (9 marks)

a. 1 mark

{1, 2, 3, 4, 6} (A1)

b. 2 marks

$\frac{18+22}{100}$ (A1)

$=\frac{40}{100}$

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

c.

i. 2 marks

$\frac{3}{5}$ (A1)

$=0.6$ (A1)

ii. 2 marks

Yes. (A1)

The number of trials is large. (A1)

d. 2 marks

As the number of trials increases, the experimental probability will get closer to (A1)
the theoretical probability. (A1)

2022 Year 10 Mathematics
Probability 2 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

_____

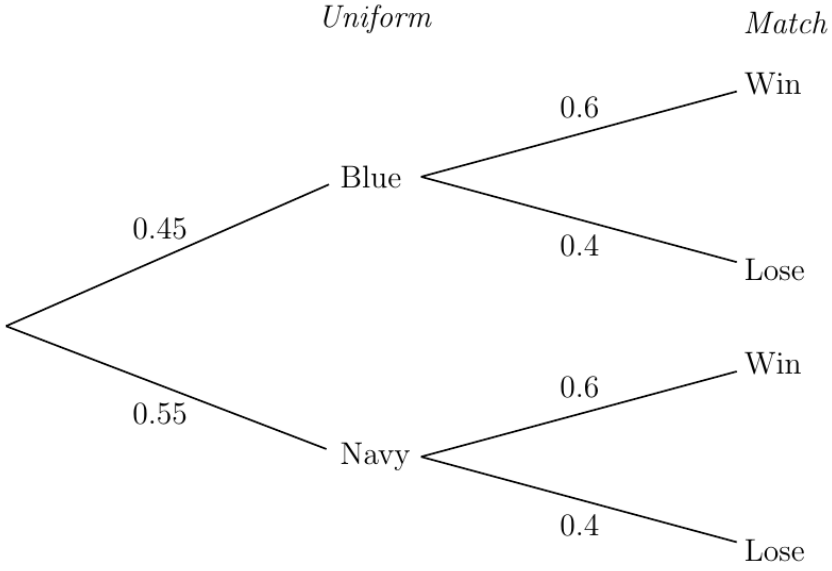
_____

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 uniform worn. 1 mark

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

2022 Year 10 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 between the ages of 15 and 17? 2 marks
Justify your answer.

_____

_____

Question 2 (11 marks)
The speeds, in km/h, of cars passing through a particular intersection are recorded one week.
The following back-to-back stem-and-leaf plot shows the results grouped into weekdays and weekend.

Weekend						Weekdays				
6	5	4	3	1	5	9				
	8	4	3	2	6	4	5	7		
		9	5	2	7	2	3	3	5	9
			4	3	8	1	3	9		
				5	9	3	5			
					10	2				

5|9 means 59 km/hr

a. How many cars were recorded in each group? 1 mark

_____

b. Find the mean speed for cars passing through the intersection on a weekday. 2 marks

_____

_____

_____

c. It is claimed that cars pass through the intersection with a higher speed on a weekday than on the weekend. 2 marks
Justify this claim by comparing the median speed of the two groups.

_____

_____

d. All of the cars that had a speed of at least 80 km/h were issued with a fine. 2 marks
Find the percentage of cars in the sample that were issued with a fine.

_____

_____

2022 Year 10 Mathematics
Single Variable Statistics Test
Total marks: 20 marks

Question 1 (9 marks)

a. 1 mark

Population (A1)

b. 1 mark

Categorical (A1)

c. 2 marks

One possible answer is:
No, since some of the 6% could be no responses/invalid responses.

- Correct decision supported with a reasonable statement. (A1)×2
- Do not award any marks for stating just yes or no.

d. 2 marks

Possible answers are:
- Cheaper
- Quicker
- Easier to manage

- Two valid statements. (A1)×2

e. 2 marks

Possible justification for yes:
- Australian Bureau of Statistics is a reliable agency.
- The sample was taken from several major cities in Australia.

Possible justification for no:
- The sample only includes teens from ages 15-17.
- More details such as sample size and sample data are required.
- Survey method is not stated.

- Correct decision supported with a reasonable statement. (A1)×2
- Do not award any mark for stating just yes or no.

f. 1 mark

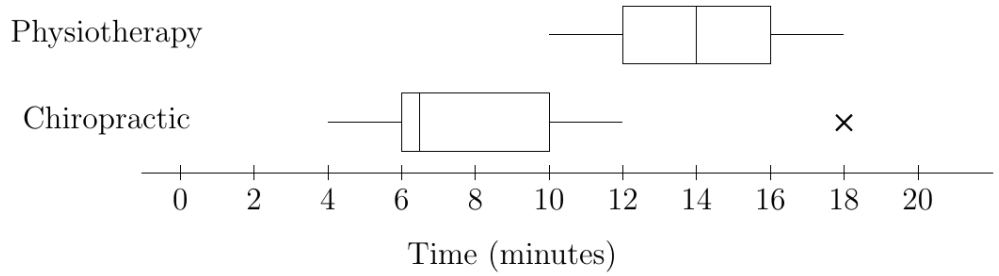
Possible answers are:
- Increase the sample size.
- Sample from more Australian cities.
- Expand the ages of teenagers being surveyed to include the age groups 11-14 and 18-19.

Accept any valid statement. (A1)

2022 Year 10 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

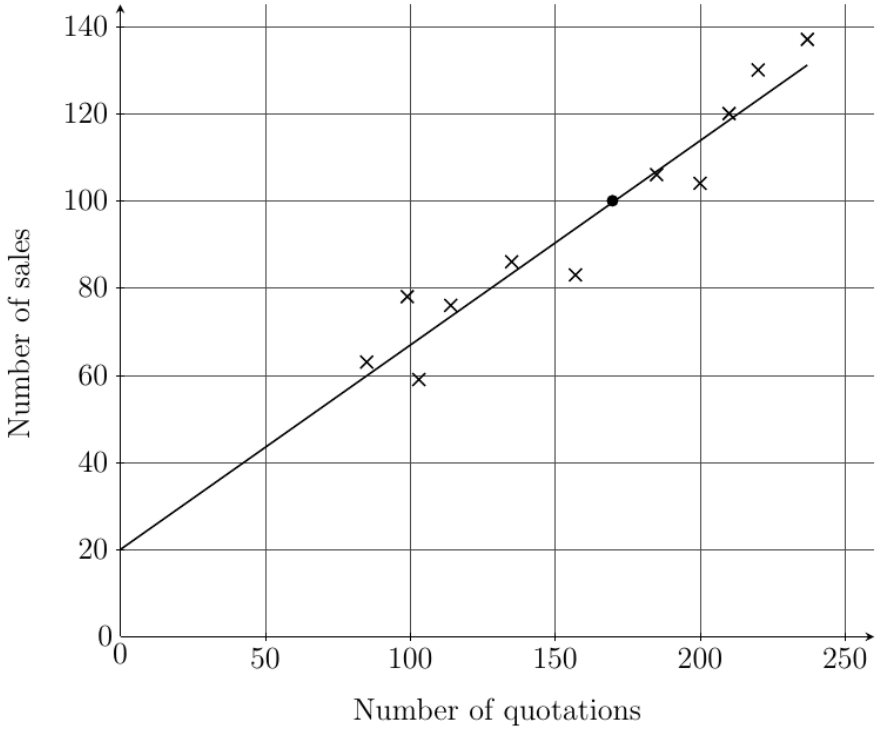
_____

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 a positive or negative correlation? 1 mark
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 of sales. 2 marks

_____

_____

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 × 0.473 + 20. (A1)×2

f.

i. 2 marks

Number of sales
= 200 × 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 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

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. $x = -2, y = 5$

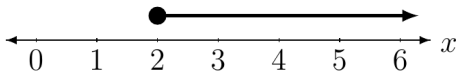
D. $x = 2, y = -5$

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

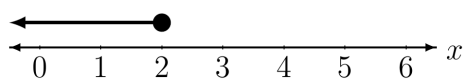
Question 3

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

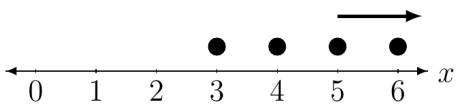
A.



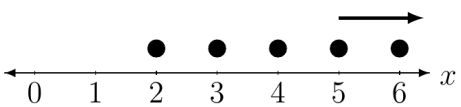
B.



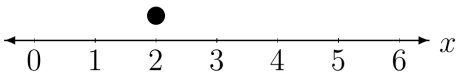
C.



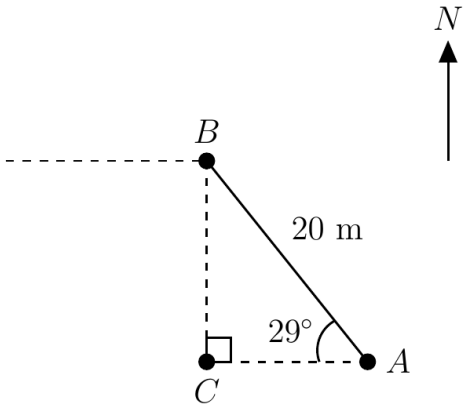
D.



E.



The following information relates to Questions 11 – 12.



Question 11
In the diagram above, the bearing of A from B is
A. 029º
B. 061º
C. 119º
D. 151º
E. 331º

Question 12
The perimeter of triangle ABC is given by
A. $400\sin(29º)\cos(29º)$ m
B. $(20\cos(61º) + 20\sin(29º) + 20)$ m
C. $(20\sin(61º) + 20\cos(29º) + 20)$ m
D. $(20\cos(29º) + 20\sin(29º))$ m
E. $(20\cos(29º) + 20\sin(29º) + 20)$ m

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

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 10A 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

$$\begin{aligned} 3(4x-5)(4x+5) &= 3(16x^2-25) \\ &= 48x^2-75 \end{aligned}$$

Answer is **B**.

Question 2

Subtracting $3x + y = 11$ from $3x - 2y = -4$ gives

$$\begin{aligned} 3x-2y-(3x+y) &= -4-11 \\ -3y &= -15 \\ y &= 5 \end{aligned}$$

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)

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

b. 2 marks

The volume of the water is

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

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

c. 2 marks

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

$= 1 : 27$ (A1)

● Accept $1^3 : 3^3 = 1 : 27$.

d.

i. 2 marks

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

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

$= 1 : 26$ (A1)

● Accept $1 : (27 - 1) = 1 : 26$.

ii. 2 marks

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

$1 : 26 = 30 : t$ (A1)

$t = 30 \times 26$

$= 780$ seconds (A1)

● Accept 13 minutes.

2022 Year 10A Mathematics
Indices and Surds Test

Time allowed: 1 hour
Total marks: 20 marks

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 $\frac{\sqrt{5}}{\sqrt{6}}\times\sqrt{42}$. 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)

$= y^2$ (A1)

c. 2 marks

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

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

d. 3 marks

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

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

$-5x = 10$

$x = -2$ (A1)

2022 Year 10A Mathematics
Expressions, Equations and Linear Relationships Test

Time allowed: 1 hour
Total marks: 20 marks

Question 1 (11 marks)

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

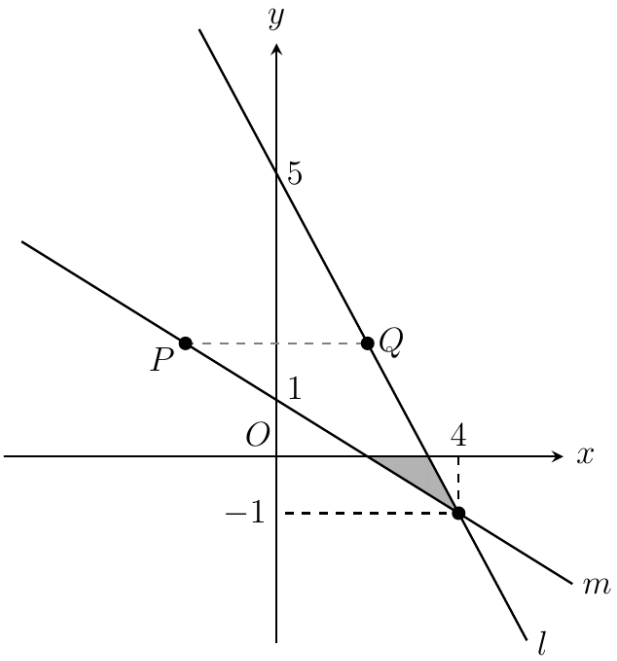
b. Rearrange the equation $\frac{1}{p^2}+q=r$ to make p the subject. 2 marks

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

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 $y = -\frac{1}{2}x + 1$.



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*

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

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

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

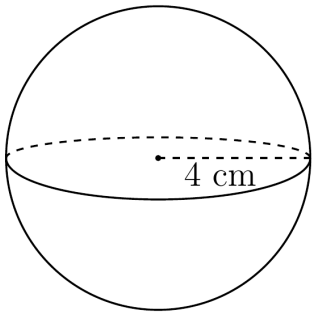
$$t=\frac{4}{15} \text{ hours} \quad \text{(A1)}$$

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

2022 Year 10A Mathematics
Measurement Test

Time allowed: 1 hour
Total marks: 20 marks

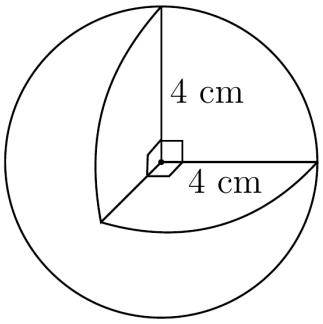
Question 1 (9 marks)
Consider the sphere shown below.



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.

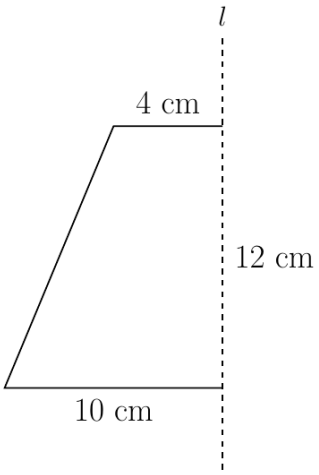


i. Find the volume of the remaining part of the sphere. 2 marks
Write your answer as an improper fraction in terms of π.

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

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

$10x=48+4x$ (A1)

$6x=48$

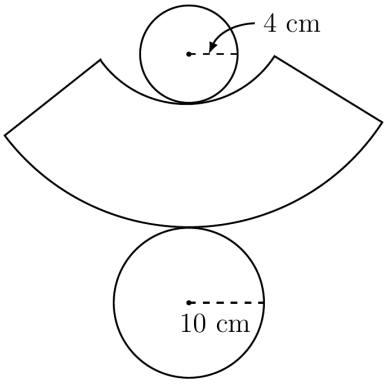
$x=8$ (A1)

c. 3 marks

$\frac{1}{3}\times\pi\times10^2\times20-\frac{1}{3}\times\pi\times4^2\times8$ (A1)×2

$=624\pi$ cm^3 (A1)

d. 3 marks



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

2022 Year 10A Mathematics
Quadratic Expressions, Quadratic Equations and Parabolas Test

Time allowed: 1 hour
Total marks: 25 marks

Question 1 (14 marks)

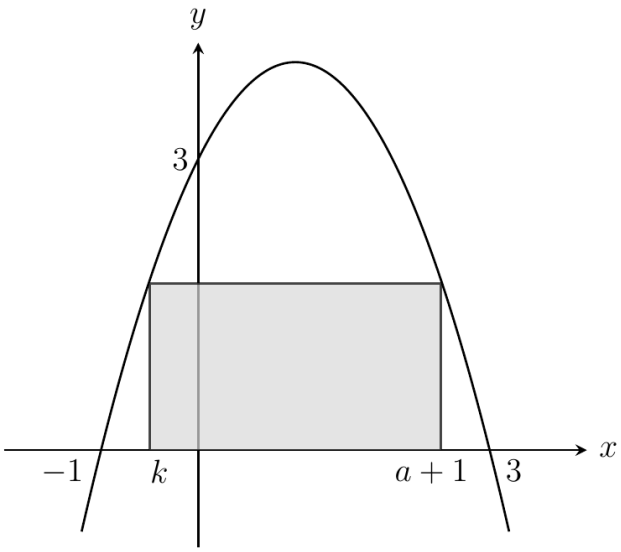
a. Factorise $3x^2 - 6x - 24$. 2 marks

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 10A 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)

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

b. 2 marks

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

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

$(x+9)^2 = 16$

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

$x = -9 \pm 4$

$x = -13,\ -5$ (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

$2l + 2 = 4w$

$l = 2w - 1$

- Correct working is shown. (A1)

ii. 4 marks

Since the area of the floor is 408 cm^2

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

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

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

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

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

$w = 6$ (A1)

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

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

2022 Year 10A 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

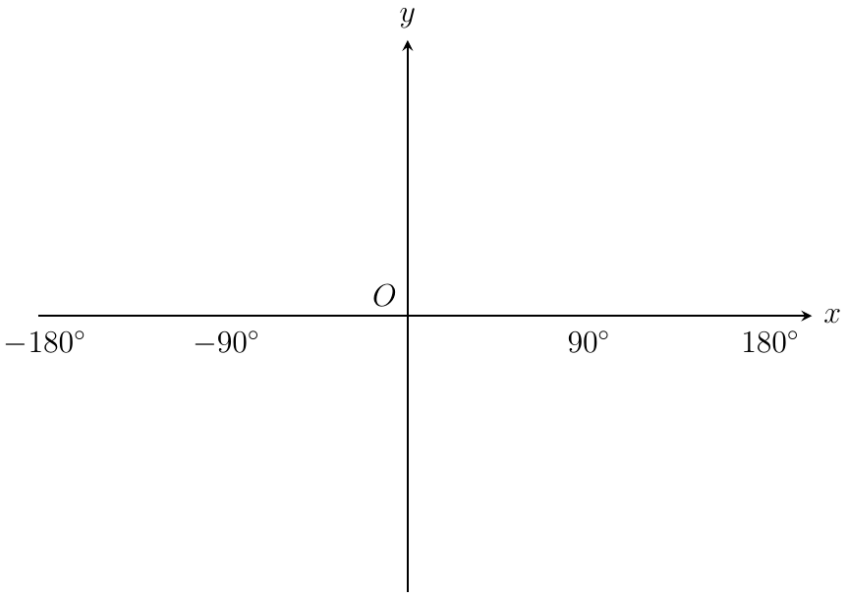
b. Complete the table below by writing down the appropriate symbols or numbers. 2 marks

θ	$\sin(\theta)$	$\cos(\theta)$	$\tan(\theta)$
0^o	0		0
	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{2}}{2}$	1

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

Question 2 (8 marks)

a. Sketch the graph of $y = \tan(x)$ for $-180^\circ \le x \le 180^\circ$ on the set of axes below. 3 marks



b. Solve the equation $\tan(x) = -0.45$ for $-180^\circ \le x \le 180^\circ$. 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

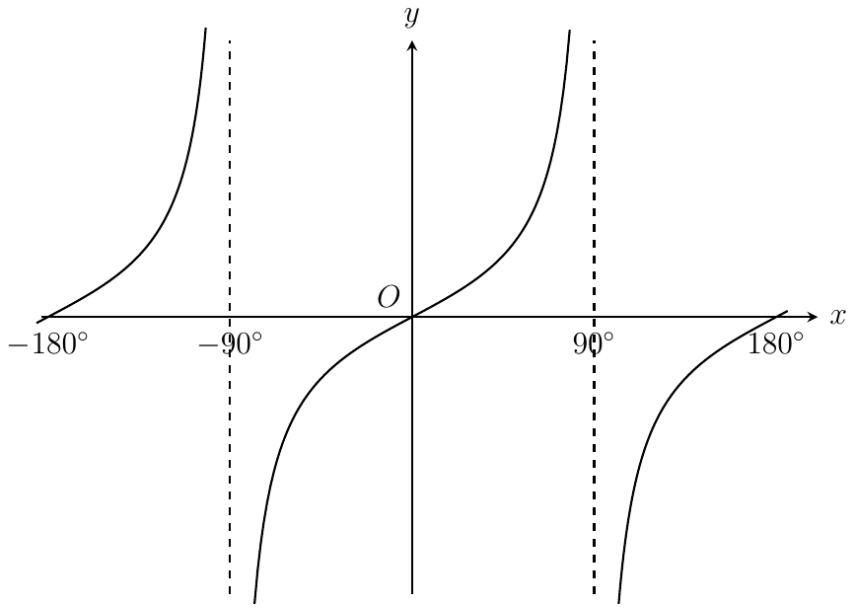
True False

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

True False

Question 2 (8 marks)

a. 3 marks



- Correct shape. (A1)
- Vertical asymptotes at $x = \pm 90^\circ$. (A1)
- Sketched graph intersects the x-axis at $x = 0^\circ$ and $x = \pm 180^\circ$. (A1)

b. 2 marks

$$\tan(x) = -0.45$$
$$x = \tan^{-1}(-0.45)$$
$$\approx -24.2^\circ$$

- Correct first solution. (A1)

The second solution is $x = 180^\circ + \tan^{-1}(-0.45) = 155.8^\circ$. (A1)

c.

i. 1 mark

False (A1)

- The period of the sine graph is 360°.

ii. 1 mark

True (A1)

iii. 1 mark

False (A1)

- $y = \tan(x)$ passes through the point $(45^\circ, 1)$.

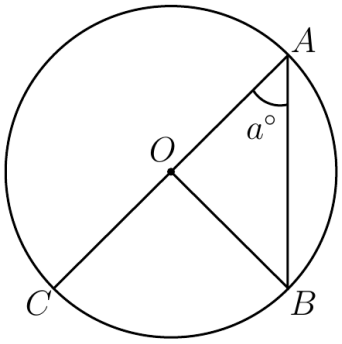
2022 Year 10A Mathematics
Geometrical Figures Test

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, $\angle OAB = a^\circ$. 6 marks

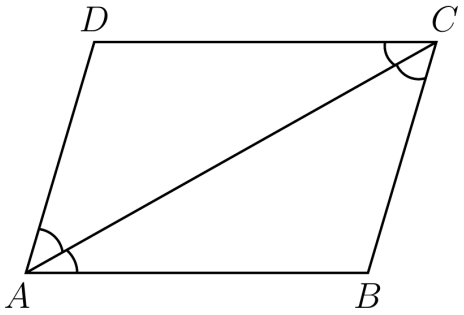


Show that $\angle BOC = 2a^\circ$ using two different proofs.

First proof:

Second proof:

b. In the parallelogram below, diagonal AC bisects angle BAD. 3 marks



Show that diagonal AC also bisects angle BCD.

Question 3 (6 marks)

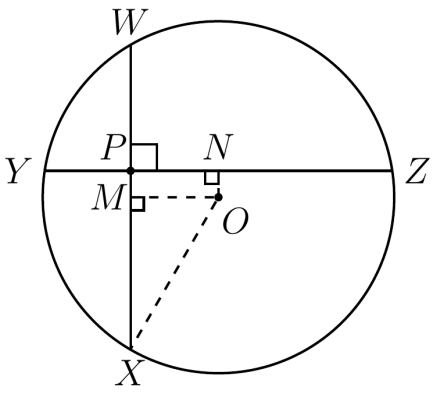
a. 2 marks

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)

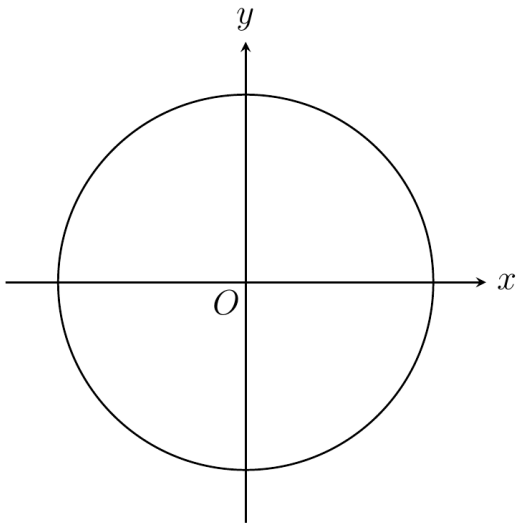
OX is a radius of the circle. Since OMX is a right-angled triangle, by Pythagoras' theorem
$OX^2 = OM^2 + XM^2 = 8^2 + 14^2 = 260$. (A1)

2022 Year 10A 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

_____

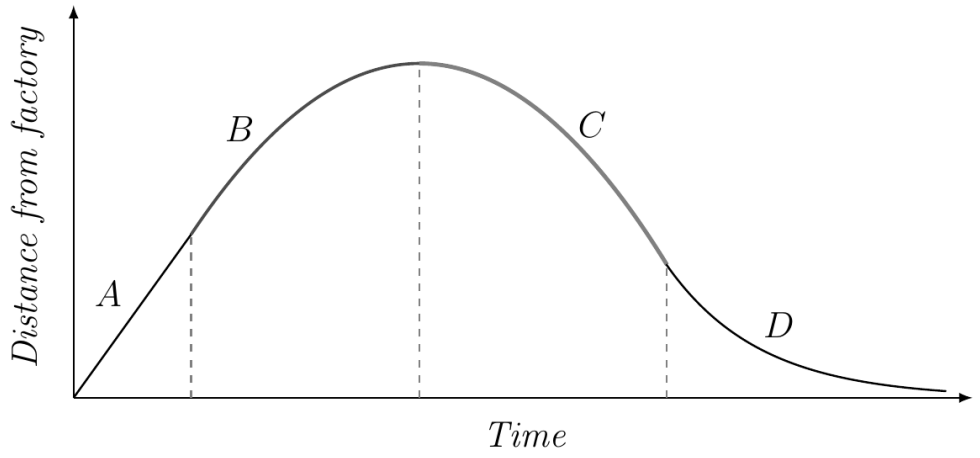
_____

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)

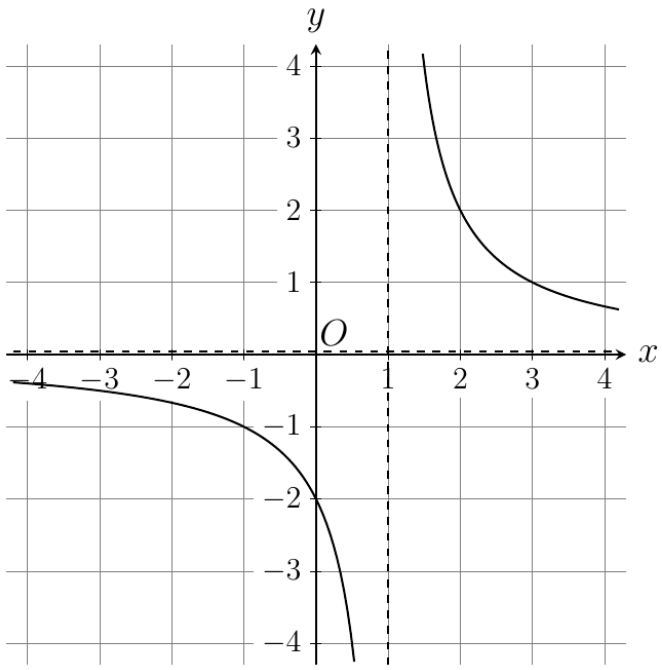
c. 2 marks

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

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

$x = 2$ (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 10A 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

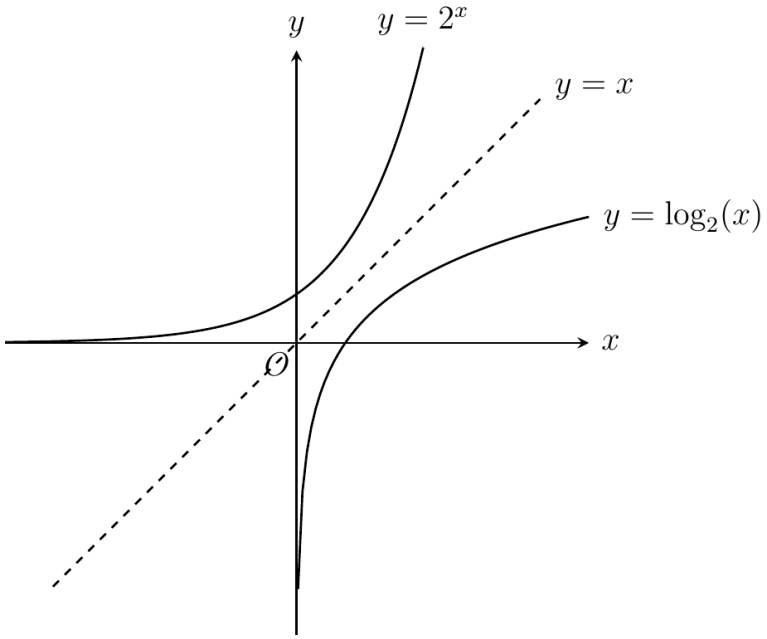
_____

_____

_____

_____

Question 3 (5 marks)
Consider the graphs $y = 2^x$ and $y = \log_2(x)$ shown below.



a. Write down the equation of the asymptote of $y = \log_2(x)$. 1 mark

_____

b. Complete the following sentence by writing down the appropriate word in the gap. 1 mark

The graphs $y = 2^x$ and $y = \log_2(x)$ are _____ about the line $y = x$.

c. Show that the x-intercept of $y = \log_2(x)$ is $x = 1$. 1 mark

_____

_____

d. Use two different methods to find the y-intercept of $y = 2^x$. 2 marks

_____

_____

_____

_____

2022 Year 10A 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 10A 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

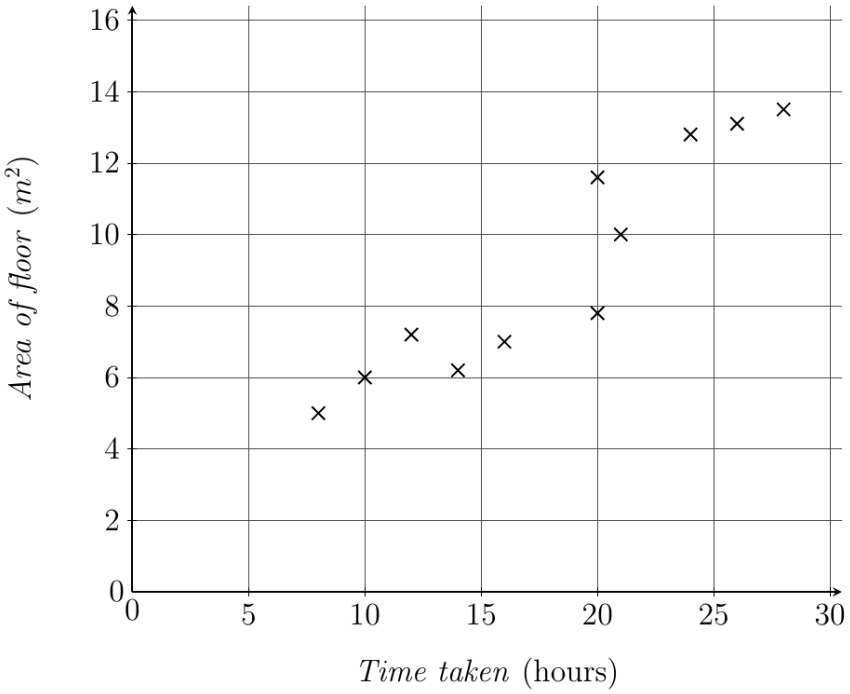
_____

_____

Question 2 (11 marks)
A professional tiler records the *area of floor*, in m^2, 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 (m^2)	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 10A Mathematics
Single Variable and Bivariate Statistics Test
Total marks: 20 marks

Question 1 (9 marks)

a. 2 marks

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

$\approx \$12.51$

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

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

$\approx \$13.98$

- 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 10A 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

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

A. $-\sqrt{2}+5$

B. $\sqrt{2}+5$

C. $\sqrt{5}+2$

D. $\sqrt{5}-2$

E. $\frac{1}{\sqrt{5}-2}$

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. $p = –2, q = –5$

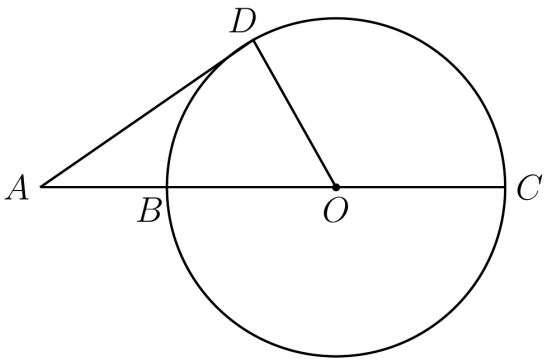
B. $p = 2, q = –5$

C. $p = 2, q = 5$

D. $p = 2, q = –3$

E. $p = –5, q = –2$

Question 5 (5 marks)
In the diagram below, the centre of the circle is at point O.
AD is a tangent to the circle.



a. Show that $AD^2 = OA^2 - OD^2$. 2 marks

b. Hence show that $AD^2 = AB \times AC$. 3 marks

END OF SECTION B

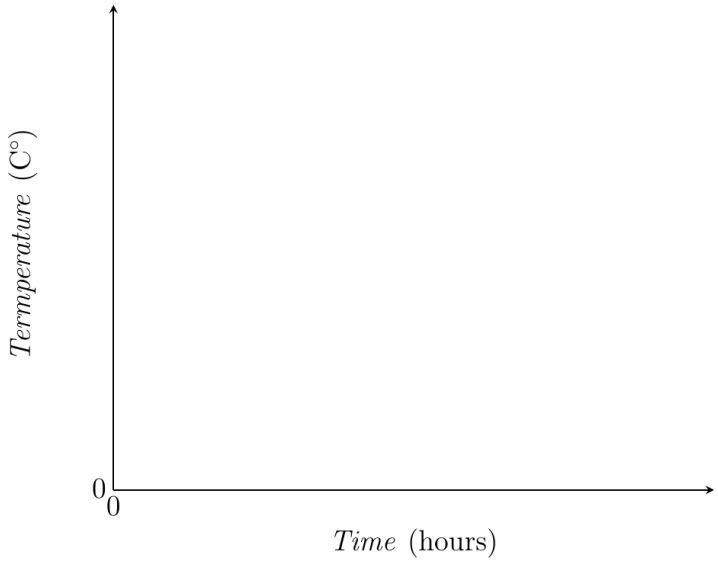
Question 2 (10 marks)

The temperature, T ºC, inside a room at t hours can be modelled by the hyperbolic function $T(t) = \dfrac{5t + 250}{t + 10}$.

a. Write down the domain of $T(t)$. 1 mark

b. Show that $T(t) = 5 + \dfrac{200}{t + 10}$. 2 marks

c. Sketch the graph of $y = T(t)$ on the set of axes provided below. 4 marks
Indicate any axis intercepts and label any asymptotes with their equations.



2022 YEAR 10A 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**.

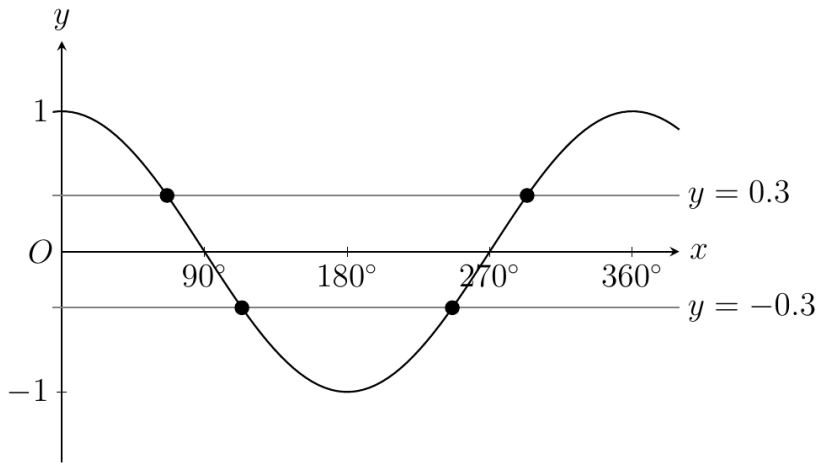
Question 2

$$\frac{1}{\sqrt{5}+2} = \frac{1}{\sqrt{5}+2} \times \frac{\sqrt{5}-2}{\sqrt{5}-2}$$
$$= \frac{\sqrt{5}-2}{5-4}$$
$$= \sqrt{5}-2$$

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

Answer is **D**.

Question 14



There are four points of intersection.

Answer is **C**.

Question 15

It can be concluded that $\sqrt{2}$ is an irrational number.

Answer is **B**.

SECTION C

Question 1 (10 marks)

a.

i. 1 mark

The formula *amount/rate = time* is used where the amount of work is 1 and the combined rate of Damian and Eryn is $\frac{1}{t}+\frac{1}{t-24}$ (A1)

ii. 3 marks

$$\frac{1}{\frac{1}{t}+\frac{1}{t-24}}=16$$

$$\frac{1}{16}=\frac{1}{t}+\frac{1}{t-24} \quad \text{(A1)}$$

$$t(t-24)=16(t-24)+16t \quad \text{(A1)}$$

$$t^2-24t=16t-16\times 24+16t$$

$$t^2-56t+384=0 \quad \text{(A1)}$$

b. 1 mark

$D = (-56)^2 - 4 \times 1 \times 384 = 1600$.

Since $D > 0$, the equation has two solutions.

● Calculated the correct discriminant to show the required result. (A1)

c. 3 marks

Using the quadratic formula

$$t=\frac{-(-56)\pm\sqrt{1600}}{2} \quad \text{(A1)}$$

$$=\frac{56\pm 40}{2}$$

$$=8,\ 48 \quad \text{(A1)}$$

● Accept factorising LHS to obtain $(t - 8)(t - 48) = 0$ instead.

But since $t > 24$, $t = 48$ is the only possible solution. (A1)

It takes Damian 48 minutes to finish the task himself.

e. 2 marks

$$\frac{5t+250}{t+10}=13 \quad \text{(A1)}$$
$$5t+250=13(t+10)$$
$$5t+250=13t+130$$
$$-8t=-120$$
$$t=15 \quad \text{(A1)}$$

The sensor will beep after 15 hours.