

Blacktown Boys' High School

2023 Year 12

HSC Trial Examination

Mathematics Advanced

General Instructions

- Reading time 10 minutes
- Working time 3 hours
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided for this paper
- All diagrams are not drawn to scale
- In Questions in Section II, show all relevant mathematical reasoning and/or calculations

Total marks: Section I – 10 marks (pages 3 – 8)

- 100
- Attempt Questions 1 10
- Allow about 15 minutes for this section

Section II - 90 marks (pages 9 - 35)

- Attempt Questions 11 32
- Allow about 2 hours and 45 minutes for this section

Assessor: X. Chirgwin

Student Name:

Students are advised that this is a trial examination only and cannot in any way guarantee the content or format of the 2023 Higher School Certificate Examination.

- BLANK PAGE -

10 marks Attempt Questions 1–10 Allow about 15 minutes for this section

Use the multiple choice answer sheet for Questions 1–10.

- 1 Which of the following is a many-to-one relation?
 - A. $x^2 + y^2 = 4$
 - B. $x = y^2 + 4$
 - C. y = |x 4|
 - D. $y = 4e^x$
- 2 An infinite geometric series has a first term of 15 and a limiting sum of 10.5. What is the common ratio?

A. $\frac{7}{10}$ B. $-\frac{7}{10}$ C. $\frac{3}{7}$ D. $-\frac{3}{7}$

- 3 In a normally distributed set of scores, the mean is 61 and the standard deviation is 8. Approximately what percentage of the scores will lie between 53 and 85?
 - A. 83.85%
 - B. 81.5%
 - C. 65.7%
 - D. 49.85%

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination

4 $\int \frac{9^x}{2} dx$ is equivalent to which of the following, where *C* is a constant?

A. $\frac{2 \times 9^{x}}{\ln 9} + C$ B. $\frac{9^{x}}{2 \ln 3} + C$ C. $\frac{9^{x}}{\ln 9} + C$ D. $\frac{9^{x}}{4 \ln 3} + C$

5 Sayem has six different pairs of socks. If two socks are selected at random, what is the probability that they will be a matching pair?

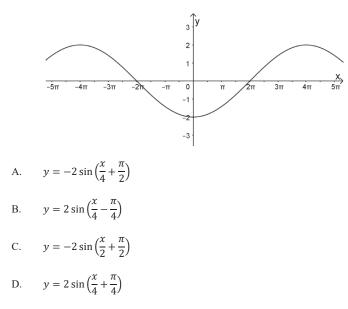
A. $\frac{1}{6}$ B. $\frac{1}{11}$ C. $\frac{1}{36}$ D. $\frac{1}{132}$

6 The function $y = \log_e x$ is transformed to $y = \log_e(3x - 3)$.

Which of the following describes the transformation that took place?

- A. Horizontal dilation factor 3, followed by translation right 1 unit.
- B. Horizontal dilation factor 3, followed by translation right 3 units.
- C. Horizontal dilation factor $\frac{1}{3}$, followed by translation right 1 unit.
- D. Horizontal dilation factor $\frac{1}{3}$, followed by translation right 3 units.

7 Which of the following is the correct equation for the graph shown?



8 Shiv invests money for three years at 2% per half year, compounded every half year.

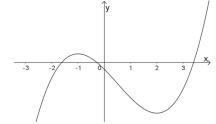
Compound values of \$1 Interest rate per period Period 1% 2% 3% 4% 1.010 1.020 1.030 1.040 1 2 1.020 1.040 1.061 1.082 3 1.030 1.061 1.093 1.125 4 1.041 1.082 1.126 1.170 5 1.051 1.104 1.159 1.217 6 1.062 1.126 1.194 1.265

Using the table, which figure should Shiv use to calculate his investment?

- A. 1.020
- B. 1.061
- C. 1.126
- D. 1.265

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination

9 The diagram shows part of y = f(x) which has a local maximum at x = -1 and a local minimum at x = 2.



Which of the following shows the correct relationship between f'(-1), f(0), and f''(2)?

- A. f(0) < f''(2) < f'(-1)
- B. f(0) < f'(-1) < f''(2)
- C. f''(2) < f'(-1) < f(0)
- D. f''(2) < f(0) < f'(-1)
- 10 It is known that f(x) is an odd function and g(x) is an even function. Given that f(5) = -3 and g(3) = -5, what is the value of f(g(-3)) g(f(-5))?
 - A. 15
 - B. 8
 - C. 2
 - D. -8

End of Section I

Student Name:

Multiple Choice Answer Sheet

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample:	2 + 4 =	(A) 2	(B) 6	(C) 8	(D) 9
		$A \bigcirc$	В 🔴	С 🔾	D 🔾

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

 $A \bullet B \not = C \bigcirc D \bigcirc$

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word 'correct' and drawing an arrow as follows.



Start → Here	1.	АO	вО	сO	DO
	2.	АO	вО	СО	DO
	3.	АO	вО	СО	DO
	4.	АO	вО	СО	DO
	5.	АO	вО	СО	DO
	6.	ΛO	вО	СО	DO
	7.	АO	вО	СО	DO
	8.	АO	вО	СО	DO
	9.	АO	вО	СО	DO
	10.	АO	вО	СО	DO

- BLANK PAGE -

-7-

-8-

Mathematics Advanced

Section II Answer Booklet 1

90 marks Attempt Questions 11 – 32 Allow about 2 hours and 45 minutes for this section

Booklet 1 – Attempt Questions 11 – 22 (45 marks) Booklet 2 – Attempt Questions 23 – 32 (45 marks)

Instructions

- Answer the Questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your response should include relevant mathematical reasoning and/or calculations
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

- BLANK PAGE -

Student Name:

BBHS	2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination		BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination
Ques	tion 11 (2 marks)		Question 14 (5 marks)
Diffe	rentiate $f(x) = \log_e(10x - 1) + \tan 5x$ with respect to x.	2	Given that $f(x) = \frac{1}{2x - 1}$ and $g(x) = 3x + 2$
			(a) Find $f(g(x))$ in the simplest form.
Ques	tion 12 (3 marks)		
For th	ne arithmetic sequences 6, 17, 28, 39,		(b) Find the domain of $f(g(x))$.
(a)	What is the 13 th term?	2	(0) Find the domain of $f(g(x))$.
			(c) Sketch $y = f(g(x)) + 1$, showing all intercepts and asymptotes.
(b)	Find the sum of the first 21 terms.	1	
(0)			
-	tion 13 (2 marks)		
numb	number of days, D , to complete a research project is inversely proportional to the er of researchers, R , who are working. The research project takes 123 days to lete when there are 7 people working on it. Find the equation relating D and R .	2	

	$\frac{1}{c-1}$ and $g(z)$				
and $f(g(x))$	in the simplest	form.			
ind the domai	in of $f(g(x))$.				
1 . 1					
$\operatorname{ketch} y = f(x)$	g(x))+1, sho	owing all int	tercepts and	asymptotes	

BBHS 2023 Year 12 Mathematics Advanced Assessmen	t Task 4 Trial Examination		BBHS	2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination	
Question 15 (4 marks)			Questi	ion 17 (4 marks)	
Saron and Rayaan take their driving tests on the sam passing his driving test is 0.65. The probability of b 0.533.			Find	$\int \left(\left(\frac{x}{x} - \frac{x}{x} \right) \right) dx$	2
(a) What is the probability of Saron passing his	s driving test?	1	(a)	$\int \left(6x^2 - \sin\frac{x}{3}\right) dx$	2
(b) What is the probability of both Saron and R	ayaan failing their driving tests?	2	(b)	$\int_{0}^{1} \frac{1}{(3-2x)^{5}} dx$	2
(c) What is the probability of at least one of the		1			
Question 16 (3 marks) Find the gradient of the normal to the curve $y = \frac{(4)^2}{2}$		3	The th	ion 18 (3 marks) ird and fifth terms of a geometric series are 21.6 and 31.104 respectively. Find lues of the first term and the common ratio.	3
			the var		

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination **Question 19** (5 marks) Question 20 (4 marks) The following shows a sketch of part of the curve $y = \frac{10}{2x + 5\sqrt{x}}$, x > 0. The mean mass of a golden retriever dog is 34 kg and the standard deviation is 5 kg. The finite region R shown is bounded by the curve, the x-axis, and the lines with What is the z-score of a 28 kg golden retriever dog? 1 (a) equations x = 1 and x = 4. The recommended mass for golden retrievers is between 24 kg and 34 kg. (b) 1 If a golden retriever's mass has a z-score of 1.8, what is the minimum mass it needs to lose to lie within the healthy mass range? 0 10 The table below shows corresponding values of x and y for y =(a) Complete the table by giving the missing value of y to 4 decimal places. 1 2 3 4 х It is known from statistical table that for this distribution approximately 79% 3 (c) 1.4286 0.9033 0.5556 y of the golden retrievers have a mass less than 38 kg. What is the approximate percentage of golden retrievers with a mass between 30 kg and 44 kg? Using the trapezoidal rule and the 4 function values in the table in part (a), (b) find an estimate for the area of R, giving your answer to 4 decimal places. With reference to the curve, explain whether your estimate in part (b) is an (c) overestimate or an underestimate for the area of *R*.

1

2

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination			BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination				
Questio	on 21 (4 marks)		Questi	Question 22 (5 marks)			
(a)	Prove the identity $\frac{1}{\sin x + 1} - \frac{1}{\sin x - 1} = 2 \sec^2 x$	2	A bott given l	le of vintage wine cost \$375 when first released. After <i>t</i> years its value, \$ <i>V</i> , is by $V = 375e^{0.05t}$.			
			(a)	Find the value of the bottle of wine after 7 years, correct to the nearest dollar.	1		
			(b)	Find how many years it takes for the value of the wine to increase to \$1200 per bottle. Round your answer to 1 decimal place.	2		
(b)	Hence find $\int_{0}^{\frac{\pi}{4}} \left(\frac{1}{3\sin x + 3} - \frac{1}{3\sin x - 3} \right) dx$	2					
	$J_0 = (3.5 \text{ m} x + 3.5 \text{ m} x - 3)$						
			(c)	What is the rate of increase in the value of the wine 7 years after it was first released? Round your answer to 1 decimal place.	2		

End of Question 22 Proceed to Booklet 2

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination Section II extra writing space	
If you use this space, clearly indicate which question you are answering.	

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Mathematics Advanced

Section II Answer Booklet 2

Booklet 2 - Attempt Questions 23 - 32 (45 marks)

Instructions

- Answer the Questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Your response should include relevant mathematical reasoning and/or calculations
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

- BLANK PAGE -

Student Name:

Question 23 (5 marks)

One end of an elastic string was attached to a horizontal bar and a mass, m grams, was attached to the other end. The mass was suspended freely and allowed to settle.

The length of the string, l mm, was recorded, for various masses as follows.

т	100	200	300	400	500	600
l	228	236	256	278	285	301

- (a) Calculate the Pearson's correlation coefficient, correct to two significant figures, and use it to describe the association between the mass and the length in terms of strength and direction.
- (b) Determine the equation of the least-squares regression line of l in terms of m. 2 Round your values to two significant figures.

(c) Calculate the mass attached to the string if the string length is 275 mm, correct to the nearest gram.

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination

Question 24 (6 marks)

2

1

The table below shows the present value interest factors for some monthly interest rates and loan periods in months.

	Present value of \$1							
Period	0.0060	0.0065	0.0070	0.0075				
46	40.09350	39.64965	39.21263	38.78231				
47	40.84841	40.38714	39.93310	39.48617				
48	41.59882	41.11986	40.64856	40.18478				
49	42.34475	41.84785	41.35905	40.87820				

Gurnoor borrows \$22 000 for a car. He arranges to repay the loan with monthly repayments over 4 years. He is charged 7.8% per annum interest.

2

2

BBHS	2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination		BBHS	2023 Year 12 Mathematics
Quest	tion 25 (4 marks)		Quest	tion 26 (3 marks)
fully c second results	nd of rechargeable batteries provides power for 32 hours when first purchased charged. After its first recharge it only provides power for 30.4 hours. After its d recharge it only supplies power for 28.88 hours. Each subsequent recharging s in the battery having 95% of its previous power available.		specia receiv	Now is a Nursing agency we lised home care. They have ed over the last five years ured in hundreds, for speci on
(a)	How many hours of power is available after the third recharge? Round to 2 decimal places.	1		Ν
			(a)	Find the maximum and
(b)	How many hours could you expect to get out of the battery?	1		
			(b)	What is the time interva number of applications
(c)	If the battery is thrown away when its charge level after recharging is less than two hours, how many times would it be recharged?	2		
			(c)	For how long between s number be at least 330

Care Now is a Nursing agency which specialises in sending nurses out to provide specialised home care. They have analysed the number of care request applications received over the last five years. They found that the number of applications (N), measured in hundreds, for specialised home care at time, t months, is given by the function

$$N = 3.6\sin\left(\frac{5\pi}{28}t\right) + 5.1$$

(a)	Find the maximum and minimum number of applications.	2
(b)	What is the time interval, in months, between two successive maximum number of applications?	1
(c)	For how long between successive maximum number of applications will the number be at least 330?	3

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination		BBHS	2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination
Question 27 (2 marks)		Quest	ion 29 (5 marks)
 The graph of y = x² is transformed into the graph of y = 3x² + 24x + 33 by the transformations: A vertical stretch with scale factor k followed by A horizontal translation of p units followed by A vertical translation of q units 	2		ass, X kg, of luggage taken on board an aircraft by a passenger can be modelled probability density function $f(x) = \begin{cases} kx^3(30 - x) & 0 \le x \le 30\\ 0 & \text{otherwise} \end{cases}$
Write down the values of k, p and q .		(a)	Show that the value of k is $\frac{1}{1215000}$
Question 28 (3 marks)		(b)	Verify that the median mass of luggage is about 20.586 kg.
The diagram below shows the graphs of $y = \frac{3}{2x+3}$ and $x + y = 2$, which intersect	3		
at <i>A</i> and <i>B</i> . The <i>x</i> values of the coordinates at <i>A</i> and <i>B</i> are -1 and 1.5 respectively.			
A y			
В		(c)	Find the probability of a passenger taking on board luggage with a mass greater than 10 kg and less than 30 kg. Round the answer to 2 decimal places.
Find the exact shaded area bounded by $y = \frac{3}{2x+3}$ and $x + y = 2$.			

2

1

BBHS	2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination		BBHS	2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination	
Quest	ion 30 (6 marks)		Questi	ion 30 (continued)	
The function $g(x) = xe^{x+1}$ has first derivative $g'(x) = (1+x)e^{x+1}$.			(d)	Sketch the curve $g(x) = xe^{x+1}$, showing the stationary point, the point of	
(a)	Show that $g''(x) = (2 + x)e^{x+1}$	1	(-)	inflection and other key features.	
(b)	Find the coordinates of the stationary point and determine its nature.	2			
(c)	Find the coordinates of any point of inflection.	1			

Question 30 continues on next page

Question 31 (5 marks)

A particle moves on the x-axis with its velocity, v m/s, given at any time, t seconds,

$$t \ge 0$$
, by $v = \frac{6}{\sqrt{5t+4}}$

Initially the particle is at the origin.

Find the initial velocity. (a) 1 (b) Find the exact acceleration of the particle after 9 seconds. 2 Find the displacement of the particle as a function of time. 2 (c)

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination

Question 32 (5 marks)

The diagram below shows a sector OAB of a circle with centre O and radius r cm. The arc AB subtends an angle θ radians at O.

A

	\frown
	r/
	$O^{\bigwedge \theta} B$
(a)	Show that the perimeter of the sector is $r(2 + \theta)$.
(b)	Given that the perimeter of the sector OAB is 22 cm, show that its area is
	$A = \frac{242\theta}{(2+\theta)^2}$

1

1

Question 32 continues on next page

-31-

Question 32 (continued)		Section II extra writing space	
		If you use this space, clearly indicate which question you are answering.	
(c)	Hence find the maximum area of the sector <i>OAB</i> . 3		
	End of paper		

BBHS 2023 Year 12 Mathematics Advanced Assessment Task 4 Trial Examination

BBHS 2023 Year 12 Mathematics Ad	vanced Assessment Task 4 Trial Examination
Section II extra writing space	
If you use this space, clearly indi-	cate which question you are answering.

Section 1		
Q1	C Option A is a circle, this is a many-to-many relation. Option B is a side-ways parabola, this is an one-to-many relation. Option C is an absolute value function, this is a many-to-one relation. Option D is an exponential function, which is an one-to-one relation.	1 Mark
Q2	$ \begin{array}{c} \mathbf{D} \\ 10.5 = \frac{15}{1 - r} \\ 1 - r = \frac{15}{10.5} \\ r = 1 - \frac{10}{7} \\ r = -\frac{3}{7} \end{array} $	1 Mark
Q3	A 53 is 1 sd below 61 and 85 is 3 sd above 61. $\frac{1}{2} \times 68\% + \frac{1}{2} \times 99.7\% = 83.85\%$	1 Mark
Q4	D $\int \frac{9^x}{2} dx$ $= \frac{1}{2} \times \frac{9^x}{\ln 9} + C$ $= \frac{9^x}{2 \ln 3^2} + C$ $= \frac{9^x}{4 \ln 3} + C$	1 Mark
Q5	B It doesn't matter which sock was chosen first, there is only one sock out of the left over 11 socks to make a matching pair.	1 Mark
Q6	C $y = \log_e x \rightarrow y = \log_e(3x)$ Horizontal dilation factor is $\frac{1}{3}$ $y = \log_e(3x) \rightarrow y = \log_e(3x - 3) = \log_e(3(x - 1))$ Translation right 1 unit	1 Mark
Q7	A $3^{1}y$ -5π -4π -3π -2π $-\pi$ 0 π 2π 3π 4π 5π $y = -2\sin\left(\frac{x}{4} + \frac{\pi}{2}\right)$	1 Mark

Q8	C 3 years compounded every half year → period is 6 2% with period 6 is 1.126	1 Mark
Q9	B f'(-1) = 0, f(0) < 0, f''(2) > 0 f(0) < f'(-1) < f''(2)	1 Mark
Q10	B g(x) is even, $g(-3) = g(3) = -5f(x)$ is odd, $f(-5) = -f(5) = 3f(g(-3)) - g(f(-5))= f(-5) - g(3)= 3 - (-5)= 8$	1 Mark

Q11	$f(x) = \log_e(10x - 1) + \tan 5x$	2 Marks
	$f'(x) = \frac{10}{10x - 1} + 5 \sec^2 5x$	Correct solution
	10x-1	1 Mark
		1 Mark Correct differentiation
		of $\log_e(10x - 1)$ or
		$\tan 5x$
Q12a	a = 6, d = 11	2 Marks
	$T_{13} = 6 + (13 - 1) \times 11$ $T_{13} = 138$	Correct solution
		1 Mark
		Identifies d and correc
		substitution into the
042	21	term formula
Q12b	$S_{21} = \frac{21}{2} (2 \times 6 + (21 - 1) \times 11)$	1 Mark Correct solution
	$S_{21} = 2436$	correct solution
Q13	$D = \frac{k}{R}$	2 Marks
	$123 = \frac{k}{7}$	Correct solution
	$\frac{125}{7}$	1 Mark
	k = 861	Obtains
	861	$123 = \frac{k}{7}$
	$D = \frac{861}{R}$	7
Q14a	$f(g(x)) = \frac{1}{2(3x+2)-1}$ $f(g(x)) = \frac{1}{\frac{1}{6x+4-1}}$ $f(g(x)) = \frac{1}{\frac{1}{6x+3}}$	2 Marks
	2(3x+2) - 1	Correct solution
	$f(g(x)) = \frac{1}{6x+4-1}$	1 Mark
	$\begin{array}{c} 0\lambda + 4 - 1 \\ 1 \end{array}$	Shows
	$f(g(x)) = \frac{1}{6x+3}$	1
		$\overline{2(3x+2)-1}$
Q14b	$6x + 3 \neq 0$	1 Mark
	$x \neq -\frac{1}{2}$	Correct solution
	$\begin{pmatrix} 2 \\ 1 \end{pmatrix}$	
	$\left(-\infty, -\frac{1}{2}\right) \cup \left(-\frac{1}{2}, \infty\right)$	
Q14c	$y = f(g(x)) + 1 = \frac{1}{6x+3} + 1$	3 Marks
	6x+3	Correct solution
	x-intercept, $y = 0$	2 Marks
		Correct graph with mo
	$\frac{1}{6x+3} + 1 = 0$	key features shown
	$\frac{1}{2} = -1$	
	$\frac{\frac{1}{6x+3} + 1 = 0}{\frac{1}{6x+3} = -1}$ 6x + 3 = -1	1 Mark
	6x = -4	Finds the x and y
	$x = -\frac{2}{3}$	intercepts
	y-intercept, $x = 0$ $y = \frac{1}{\frac{1}{6} \times 0 + 3} + 1$	
	$y = \frac{1}{6 \times 0 + 3} + 1$	
	$y = \frac{4}{3}$	
		1

	Vertical asymptote	
	$x = -\frac{1}{2}$	
	Horizontal asymptote y = 1	
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
Q15a	Prob of both pass = Prob of Rayaan pass × Prob of Saron pass $0.533 = 0.65 \times$ Prob of Saron pass Prob of Saron pass = $0.533 \div 0.65 = 0.82$	1 Mark Correct solution
Q15b	Prob of both fail = Prob of Saron fail × Prob of Rayaan fail Prob of both fail = $(1 - 0.82) \times (1 - 0.65)$ Prob of both fail = $0.18 \times 0.35 = 0.063$	2 Marks Correct solution 1 Mark Finds the probability of
Q15c	Prob of at least one fail = Complement of prob of both passes $1 - 0.533 = 0.467$	one person failing 1 Mark Correct solution
Q16	$y = \frac{(4 - x^2)}{e^{3x}}$	3 Marks Correct solution
	$\frac{dy}{dx} = \frac{e^{3x} \times (-2x) - (4 - x^2) \times 3e^{3x}}{(e^{3x})^2}$ $\frac{dy}{dx} = \frac{e^{3x}(-2x - 12 + 3x^2)}{e^{6x}}$ $\frac{dy}{dx} = \frac{-2x - 12 + 3x^2}{e^{3x}}$	2 Marks Correct gradient of tangent 1 Mark
	$dx = e^{3x}$ At (0, 4), x = 0 $m_T = \frac{-12}{e^0}$ $m_T = -12$	Correct differentiation
	$m_N = \frac{1}{12}$	

017-		2.84
Q17a	$\int \left(6x^2 - \sin\frac{x}{3}\right) dx$	2 Marks Correct solution
	5	
	$=\frac{6x^3}{3} + 3\cos\frac{x}{3} + C$	1 Mark
	$=2x^{3}+3\cos\frac{x}{3}+C$	Some correct
		integration
Q17b	$\int_{0}^{1} \frac{1}{(3-2x)^{5}} dx$	2 Marks Correct solution
l I		Correct solution
l I	$=\int_{0}^{1}(3-2x)^{-5}dx$	1 Mark
		Correct primitive
	$=\left \frac{(3-2x)^{-4}}{2}\right $	function
	$\begin{bmatrix} -4 \times -2 \end{bmatrix}_0$	
	$= \left[\frac{(3-2x)^{-4}}{-4\times-2}\right]_{0}^{1}$ $= \left[\frac{1}{8(3-2x)^{4}}\right]_{0}^{1}$	
	$[8(3-2x)^4]_0$	
	$= \left[\frac{1}{8(3-2\times1)^4} - \frac{1}{8(3-0)^4}\right]$	
	$\begin{bmatrix} 8(3-2\times1)^2 & 8(3-0)^2 \end{bmatrix}$ 1 1	
	$=\frac{1}{8} - \frac{1}{648}$	
	$=\frac{10}{1}$	
	81	
Q18	$T_3 = ar^2 = 21.6 \dots \dots (1)$	3 Marks
	$T_5 = ar^4 = 31.104 \dots (2)$	Correct solution
	$(2) \div (1)$	2 Marks
	$r^2 = 1.44$ $r = \pm 1.2$	Obtains one of the ratio
	$I = \pm 1.2$	and the first term
	$ar^2 = 21.6$	1 Mark
	$a \times 1.44 = 21.6$	Establishes T_3 and T_5
	a = 15	
Q19a	$x - \mu$	1 Mark
4254	$z = \frac{x - \mu}{\sigma}$	Correct solution
	$z = \frac{28 - 34}{5}$	
	$z = -\frac{6}{5} = -1.2$	
Q19b	$1.8 = \frac{x - 34}{5}$	1 Mark
	5 x = 43kg	Correct solution
	43 - 34 = 9	
	It needs to lose at least 9kg.	
	700/1	
Q19c	79% have a mass < 38 kg 79% $- 50\% = 29\%$	3 Marks Correct solution
	39% - 30% - 29% $\therefore 29\%$ have a mass between 34kg and 38kg.	
	∴ 29% have a mass between 30kg and 34kg.	2 Marks
		Makes significant
	95% have a mass between 24kg and 44kg.	progress
	\div 47.5% have a mass between 34kg and 44kg.	1 Marti
	\therefore % of mass between 30kg and 44kg is 29% + 47.5% = 76.5%	1 Mark Recognises 95% is
		between 24kg and 44kg
		or finds 29% is between
		34kg and 38kg
' I		

0202	10	1 Mark
Q20a	$y = \frac{10}{2 \times 3 + 5\sqrt{3}}$	1 Mark Correct solution
	$y = 0.682116 \dots$	
	$y \approx 0.6821$	
Q20b		2 Marks
	$Area = \frac{1}{2} [1.4286 + 2(0.9033 + 0.6821) + 0.5556]$	Correct solution
	<i>Area</i> = 2.5775	
		1 Mark
		Correct substitution into the trapezoidal rule
Q20c	The approximation is more because the sides of the trapezia lie above	1 Mark
	the concave up curve.	Correct solution
	у 🔪	
Q21a	$RTP: \frac{1}{\sin x + 1} - \frac{1}{\sin x - 1} = 2 \sec^2 x$	2 Marks
	$RIP: \frac{1}{\sin x + 1} - \frac{1}{\sin x - 1} = 2 \sec^2 x$	Correct solution
	1 1	1 Mark
	$LHS = \frac{1}{\sin x + 1} - \frac{1}{\sin x - 1}$	Shows
	$LHS = \frac{(\sin x - 1) - (\sin x + 1)}{(\sin x - 1) - (\sin x + 1)}$	-2
	$(\sin x - 1)(\sin x + 1)$	$\sin^2 x - 1$
	$LHS = \frac{1}{\sin x + 1} - \frac{1}{\sin x - 1}$ $LHS = \frac{(\sin x - 1) - (\sin x + 1)}{(\sin x - 1)(\sin x + 1)}$ $LHS = \frac{-2}{\sin^2 x - 1}$ $LHS = \frac{-2}{1 - \cos^2 x - 1}$ $LHS = \frac{-2}{2\cos^2 x}$ $LHS = 2\cos^2 x$	
	$LHS = \frac{-2}{-2}$	
	$\frac{1}{-2} \frac{1}{-2} \frac$	
	$LHS = \frac{2}{-\cos^2 x}$	
	$LHS = 2 \text{ Sec}^{-1} x$	
	LHS = RHS	
Q21b	$\int_{0}^{\frac{\pi}{4}} \left(\frac{1}{3\sin x + 3} - \frac{1}{3\sin x - 3} \right) dx$	2 Marks
	$\int_{0}^{1} \left(\frac{1}{3 \sin x + 3} - \frac{1}{3 \sin x - 3} \right) dx$	Correct solution
	$1 \left(\frac{\pi}{4} \right) \left(1 \right)$	1 Mark
	$=\frac{1}{3}\int_{0}^{\frac{\pi}{4}} \left(\frac{1}{\sin x+1} - \frac{1}{\sin x-1}\right) dx$	Recognises
	π	$\frac{1}{3}\int_0^{\frac{\pi}{4}} 2\sec^2 x dx$
	$=\frac{1}{3}\int_{0}^{\frac{7}{4}} 2\sec^{2}x dx$	$\left[\frac{1}{3}\right]_{0}^{2} \sec^{2} x dx$
		0
	$=\frac{2}{3}\int_0^{\frac{\pi}{4}}\sec^2 xdx$	
	$=\frac{2}{-[\tan r]^{\frac{\pi}{4}}}$	
	3^{1}	
	$= \frac{2}{3} \frac{1}{[\tan x]_{0}^{\frac{\pi}{4}}}$ $= \frac{2}{3} \frac{1}{[\tan \frac{\pi}{4} - \tan 0]}$	
	$=\frac{2}{2}$	
	$=\overline{3}$	
Q22a	$V = 375e^{0.05t}$	1 Mark
Q22a	$V = 375e^{0.05t}$ $V = 375e^{0.05\times7}$ $V = 532.15 \approx $532 (nearest dollar)$	1 Mark Correct solution

Q22b	$1200 = 375e^{0.05t}$		2 Marks
	$\frac{1200}{375} = e^{0.05t}$		Correct solution
	375 - e		
	$\ln 3.2 = 0.05t$		1 Mark
	$t = \frac{\ln 3.2}{2}$		Shows $\ln 3.2 = 0.05t$
	$t = \frac{113.2}{0.05}$		
	$t = 23.263 \approx 23.3$ years		
022-	du	0.0	2.845 mbr
Q22c	$\frac{dV}{dt} = 375 \times 0.05e^{0.05t}$	OR	2 Marks
	dt	$\frac{dV}{dt} = 0.05 \times 375e^{0.05t}$	Correct solution
	$\frac{dV}{dt} = 18.75e^{0.05t}$	dt dV	
	dt	$\frac{dv}{dt} = 0.05 \times V$	1 Mark
	A + t = 7	dt	Correct
	At $t = 7$	Further and (a)	$\frac{dV}{dV}$
	$\frac{dV}{dt} = 18.75e^{0.05 \times 7}$	From part (a)	dt
		$\frac{dV}{dt} = 0.05 \times 532$	
	$\frac{dv}{dt} = 26.60 \dots \approx 26.6$	dt	
		$\frac{dV}{dt} = 26.6$	
	The rate is \$26.6 per year	dt	
Q23a	$r = 0.99075 \dots$		2 Marks
	$r \approx 0.99$		Correct solution
	The association between the mas	s and the length is strong and	
	positive.		1 Mark
	positive.		Correct <i>r</i> value
0226	l = A + Bm		
Q23b	l = A + Bm $l = 210.6 + 0.1525 \dots m$		2 Marks
			Correct solution
	l = 210 + 0.15m		
			1 Mark
	0.000 0.10		Correct A or B value
Q23c	275 = 210 + 0.15m		1 Mark
	65 = 0.15m		Correct solution
	m = 433.33		
	$m \approx 433$ grams		
Q24a	0.078		2 Marks
Q24a	$r = \frac{0.078}{12} = 0.0065, n = 4 \times 1$	12 = 48	Correct solution
	From table: 41.11986		correct solution
	110111 (able: 41.11)00		
	Lat the monthly repairs at he of		1 Mark
	Let the monthly repayment be x .		Identifies 41.11986
	PV = 41.11986x		
	22000 = 41.11986x		
	$x = 535.021 \dots \approx \535.02		
Q24b	Total repaid = $$535.02 \times 48$		2 Marks
	Total repaid = $$25680.96$		Correct solution
	Interest = \$25680.96 - \$22000		1 Mark
	Interest = \$25680.96 - \$22000		Finds the total amount
			to be repaid
0252	Let T be the power available after the n^{th} charge		
Q25a	Let T_{n+1} be the power available after the n^{th} charge.		1 Mark
	Third charge is T_4		Correct solution
	$T_4 = 32 \times 0.95^3$		
	$T_4 = 27.436 \approx 27.44$ hours		
Q25b	32		1 Mark
4230	$S_{\infty} = \frac{S_{\infty}}{1 - 0.95}$		Correct solution
	$S_{\infty} = 640$ hours		

Q25c $T_{n+1} < 2$ $32 \times 0.05^n < 16$ $\ln 0.95^n < 16$ $\ln 0.95^n < 16$ $\ln 0.95^n < 16$ $n > 0.95^n < 16$ $n > 0.95^n < 16$ n > 160 $n > 5 \ln 15$ n > 54.05 n > 54.05 n > 54.05 n > 55.0 Power is less than 2 hours after the 55 th recharge. 2 Marks Correct solution Q26a $5.1 + 3.6 = 8.7$ Maximum number is 870 5.1 - 3.6 = 1.5 Minimum number is 150 1 Mark Finds max or min, or both 8.7 and 1.5 Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ $\frac{10}{5\pi} = 1.2$ $\frac{10}{5\pi} $			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Q25c	$T_{n+1} < 2$	2 Marks
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			Correct solution
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		$0.95^n < \frac{1}{1}$	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		10 1	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		$\ln 0.95^n < \ln \frac{1}{16}$	
$\begin{array}{c} 1 \text{ In } 5 \text{ In } 16 \\ n > \frac{\ln \frac{15}{10}}{10.95} \\ n > 54.05 \\ \therefore n = 55 \\ \hline \\ \text{Power is less than 2 hours after the 55th recharge.} \end{array}$		1	$n \ln 0.95 < \ln \frac{1}{2}$
$\begin{array}{c c} 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 $		$n \ln 0.95 < \ln \frac{1}{16}$	16
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		1 10	
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		$n > \frac{\ln 16}{16}$	
$\begin{array}{ c c c c c }\hline\hline $:$ n = 55 \\ \hline $Power is less than 2 hours after the 55th recharge. \\ \hline \hline $Q26a \\ \hline $S.1 + 3.6 = 8.7 \\ Maximum number is 870 \\ \hline $S.1 - 3.6 = 1.5 \\ Minimum number is 150 \\ \hline $Minimum number is 150 \\ \hline $Q26b \\ \hline $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2 \\ \hline $Period is 11.2 months \\ \hline $Q26c \\ \hline $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3 \\ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8 \\ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2} \\ $\frac{5\pi}{15} = \frac{7}{6} \cdot \frac{11\pi}{2} \\ $\frac{5\pi}{28} = \frac{7}{6} \cdot \frac{11\pi}{2} \\ $\frac{5\pi}{16} = \frac{7}{15} \cdot \frac{11\pi}{5} \\ \hline $\frac{10}{9} \\ $\frac{1}{9} \\ $\frac{1}{9} \\ $\frac{1}{15} - \frac{10}{12} \\ $\frac{10}{1} \\ $\frac{1}{2} & 3 & 4 & 5 & 6 & 7 & 6 & 9 & 10 & 11 \\ $Time interval in months above 330 is \\ $1.2 - 3\frac{11}{15} = 7\frac{7}{15} \\ \hline $\frac{1}{12} = 7\frac{7}{15} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\ $\frac{1}{12} \\ $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\$		$n = \frac{1}{\ln 0.95}$	
$\begin{array}{ c c c c c }\hline\hline $:$ n = 55 \\ \hline $Power is less than 2 hours after the 55th recharge. \\ \hline \hline $Q26a \\ \hline $S.1 + 3.6 = 8.7 \\ Maximum number is 870 \\ \hline $S.1 - 3.6 = 1.5 \\ Minimum number is 150 \\ \hline $Minimum number is 150 \\ \hline $Q26b \\ \hline $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2 \\ \hline $Period is 11.2 months \\ \hline $Q26c \\ \hline $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3 \\ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8 \\ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2} \\ $\frac{5\pi}{15} = \frac{7}{6} \cdot \frac{11\pi}{2} \\ $\frac{5\pi}{28} = \frac{7}{6} \cdot \frac{11\pi}{2} \\ $\frac{5\pi}{16} = \frac{7}{15} \cdot \frac{11\pi}{5} \\ \hline $\frac{10}{9} \\ $\frac{1}{9} \\ $\frac{1}{9} \\ $\frac{1}{15} - \frac{10}{12} \\ $\frac{10}{1} \\ $\frac{1}{2} & 3 & 4 & 5 & 6 & 7 & 6 & 9 & 10 & 11 \\ $Time interval in months above 330 is \\ $1.2 - 3\frac{11}{15} = 7\frac{7}{15} \\ \hline $\frac{1}{12} = 7\frac{7}{15} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\ $\frac{1}{12} \\ $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} \\ \hline $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} - \frac{7}{15} \\ \hline $\frac{1}{12} \\$			
Power is less than 2 hours after the 55 th recharge. Q26a 5.1 + 3.6 = 8.7 Maximum number is 870 5.1 - 3.6 = 1.5 Minimum number is 150 Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ Period is 11.2 months Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{15} = \frac{7\pi}{11\pi} \frac{11\pi}{6}$ $t = \frac{98}{154} \frac{15\pi}{15}$ 1 Mark Finds max or min, or both 8.7 and 1.5 2 Marks Correct solution 2 Marks Correct solution 2 Marks Correct solution 2 Marks Correct solution 2 Marks Correct solution 2 Marks 2 Marks 2 Correct solution 2 Marks 2 Marks 2 Correct solution 2 Marks 2 Marks 2 Correct solution 2 Marks 2 Marks 2 Correct solution 2 Marks 2 Mar			
Q26a 5.1 + 3.6 = 8.7 Maximum number is 870 2 Marks Correct solution S.1 - 3.6 = 1.5 Minimum number is 150 1 Mark Finds max or min, or both 8.7 and 1.5 Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ 1 Mark Finds max or min, or both 8.7 and 1.5 Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solution Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds both values of t $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10^{7} $\frac{9}{8}$ $\frac{1}{6}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10^{7} $\frac{9}{8}$ $\frac{154}{15}$ $\frac{10}{15}$ 10^{7} $\frac{10}{1}$ $\frac{10}{15}$ $\frac{10}{15}$ 10^{7} $\frac{10}{1}$ $\frac{10}{15}$ $\frac{10}{15}$ 112 $\frac{10}{15}$ $\frac{11}{15}$ $\frac{11}{15}$ $112 - 3\frac{11}{15} = 7\frac{7}{15}$ $\frac{11}{15}$ $\frac{11}{15}$		$\therefore n = 55$	
Q26a 5.1 + 3.6 = 8.7 Maximum number is 870 2 Marks Correct solution S.1 - 3.6 = 1.5 Minimum number is 150 1 Mark Finds max or min, or both 8.7 and 1.5 Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ 1 Mark Finds max or min, or both 8.7 and 1.5 Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solution Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds both values of t $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10^{7} $\frac{9}{8}$ $\frac{1}{6}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10^{7} $\frac{9}{8}$ $\frac{154}{15}$ $\frac{10}{15}$ 10^{7} $\frac{10}{1}$ $\frac{10}{15}$ $\frac{10}{15}$ 10^{7} $\frac{10}{1}$ $\frac{10}{15}$ $\frac{10}{15}$ 112 $\frac{10}{15}$ $\frac{11}{15}$ $\frac{11}{15}$ $112 - 3\frac{11}{15} = 7\frac{7}{15}$ $\frac{11}{15}$ $\frac{11}{15}$			
Maximum number is 870Correct solution $5.1 - 3.6 = 1.5$ Minimum number is 1501 Mark Finds max or min, or both 8.7 and 1.5Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ Period is 11.2 months1 Mark Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $\frac{1}{2} = \frac{7\pi}{15}, \frac{11\pi}{15}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $\frac{1}{2} = \frac{12}{5}, \frac{5\pi}{15}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds solution $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 2 Marks Finds solution $\frac{100}{9}$ $\frac{9}{1}$ $\frac{1}{1}$ $\frac{2}{1}$ $\frac{1}{1}$ $\frac{1}{2}$ $\frac{100}{9}$ $\frac{1}{1}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{1}$ $\frac{100}{9}$ $\frac{1}{1}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{154}{15} - \frac{98}{15} = 5\frac{15}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		Power is less than 2 hours after the 55 th recharge.	
Maximum number is 870Correct solution $5.1 - 3.6 = 1.5$ Minimum number is 1501 Mark Finds max or min, or both 8.7 and 1.5Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ Period is 11.2 months1 Mark Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $\frac{1}{2} = \frac{7\pi}{15}, \frac{11\pi}{15}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $\frac{1}{2} = \frac{12}{5}, \frac{5\pi}{15}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds solution $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 2 Marks Finds solution $\frac{100}{9}$ $\frac{9}{1}$ $\frac{1}{1}$ $\frac{2}{1}$ $\frac{1}{1}$ $\frac{1}{2}$ $\frac{100}{9}$ $\frac{1}{1}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{1}$ $\frac{100}{9}$ $\frac{1}{1}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{154}{15} - \frac{98}{15} = 5\frac{15}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Q26a		
Minimum number is 150Finds max or min, or both 8.7 and 1.5Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ 1 Mark Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 3 Marks Correct solution1 $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solution2 $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solution $5\pi}{t = \frac{98}{15}, \frac{154}{15}}$ 1 Mark Finds 10^{-9} $\frac{9}{8}$ $\frac{7}{16}$ 1.5 10^{-9} $\frac{9}{8}$ $\frac{7}{16}$ 1.5 10^{-9} $\frac{9}{15}, \frac{15}{15}$ 1.5 10^{-9} $\frac{9}{15}, \frac{154}{15}$ 1.5 10^{-9} $\frac{9}{15}, \frac{15}{15}, \frac{98}{15}, \frac{56}{15}, \frac{311}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		Maximum number is 870	Correct solution
Minimum number is 150Finds max or min, or both 8.7 and 1.5Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ 1 Mark Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 3 Marks Correct solution1 $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solution2 $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 3 Marks Correct solution $5\pi}{t = \frac{98}{15}, \frac{154}{15}}$ 1 Mark Finds 10^{-9} $\frac{9}{8}$ $\frac{7}{16}$ 1.5 10^{-9} $\frac{9}{8}$ $\frac{7}{16}$ 1.5 10^{-9} $\frac{9}{15}, \frac{15}{15}$ 1.5 10^{-9} $\frac{9}{15}, \frac{154}{15}$ 1.5 10^{-9} $\frac{9}{15}, \frac{15}{15}, \frac{98}{15}, \frac{56}{15}, \frac{311}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$			
Q26b $\frac{2\pi}{5\pi} = \frac{56}{5} = 11.2$ both 8.7 and 1.5Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.Marks$ Correct solutionQ26c $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $3.Marks$ Correct solution $3.6 \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $3.Marks$ Correct solution $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{16}$ $2.Marks$ Finds both values of t $\frac{10^7 y}{\frac{9}{8}}$ $\frac{1}{12}$ $\frac{10^7 y}{\frac{9}{8}}$ $\frac{1}{12}$ $\frac{10^7 y}{\frac{9}{12}}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{15}$ $\frac{1}{15}$ $\frac{1}{15}$ $\frac{1}{12}$ $\frac{1}{15}$ <tr< td=""><td></td><td></td><td>1 Mark</td></tr<>			1 Mark
Q26b $ \frac{2\pi}{5\pi} = \frac{56}{5} = 11.2 $ Period is 11.2 months $ \frac{3 \text{ Marks}}{28} $ Q26c $ 3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3 $ $ 3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8 $ $ \sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2} $ $ \frac{5\pi}{28}t = \frac{7\pi}{16}, \frac{11\pi}{6} $ $ t = \frac{98}{15}, \frac{154}{15} $ $ \frac{10}{9} \sqrt{7} $ $ \frac{9}{8} 7 $ $ \frac{10}{7} \sqrt{7} $ $ \frac{10}{9} \sqrt{7} $ $ \frac{10}{11} \sqrt{7} $ $ \frac{10}{11} \sqrt{7} $ $ \frac{10}{11} \sqrt{7} $ $ \frac{11}{15} \sqrt{7} $		Minimum number is 150	Finds max or min, or
Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{11\pi} \frac{11\pi}{6}$ $t = \frac{98}{15} \frac{15\pi}{15}$ 1 Mark Finds $t = \frac{98}{15} \frac{15\pi}{15}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$			both 8.7 and 1.5
Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{11\pi} \frac{11\pi}{6}$ $t = \frac{98}{15} \frac{15\pi}{15}$ 1 Mark Finds $t = \frac{98}{15} \frac{15\pi}{15}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$	Q26b	2π 56 - 11 2	1 Mark
Q26c $3.6 \sin\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ $3.6 \sin\left(\frac{5\pi}{28}t\right) = -1.8$ $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{11\pi} \frac{11\pi}{6}$ $t = \frac{98}{15} \frac{15\pi}{15}$ 1 Mark Finds $t = \frac{98}{15} \frac{15\pi}{15}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 1 Mark Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$			Correct solution
Q26c 3.6 sin $\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ 3.6 sin $\left(\frac{5\pi}{28}t\right) = -1.8$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{15\pi}{15}$ 1 Mark Finds sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10 10 12 Marks 13 Marks 112 3 4 5 6 7 8 9 10 $11Time interval in months below 330 is112 - 3\frac{11}{15} = 7\frac{7}{15}$			
Q26c 3.6 sin $\left(\frac{5\pi}{28}t\right) + 5.1 = 3.3$ 3.6 sin $\left(\frac{5\pi}{28}t\right) = -1.8$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{15\pi}{15}$ 1 Mark Finds sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10 10 12 Marks 13 Marks 112 3 4 5 6 7 8 9 10 $11Time interval in months below 330 is112 - 3\frac{11}{15} = 7\frac{7}{15}$			
3.6 sin $\left(\frac{5\pi}{28}t\right) = -1.8$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10° y $\frac{9}{8}$ 7° $\frac{1}{6}$ $\frac{1}{2}$ 10° y $\frac{9}{8}$ 7° $\frac{1}{6}$ $\frac{1}{2}$ $\frac{10^{\circ}}$ y $\frac{9}{8}$ 7° $\frac{1}{12}$ $3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11}$ Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		Period is 11.2 months	
3.6 sin $\left(\frac{5\pi}{28}t\right) = -1.8$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10° y $\frac{9}{8}$ 7° $\frac{1}{6}$ $\frac{1}{2}$ 10° y $\frac{9}{8}$ 7° $\frac{1}{6}$ $\frac{1}{2}$ $\frac{10^{\circ}}$ y $\frac{9}{8}$ 7° $\frac{1}{12}$ $3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11}$ Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$			
3.6 sin $\left(\frac{5\pi}{28}t\right) = -1.8$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ $\frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6}$ $t = \frac{98}{15}, \frac{154}{15}$ 1 Mark Finds sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ 10° y $\frac{9}{8}$ 7° $\frac{1}{6}$ $\frac{1}{2}$ 10° y $\frac{9}{8}$ 7° $\frac{1}{6}$ $\frac{1}{2}$ $\frac{10^{\circ}}$ y $\frac{9}{8}$ 7° $\frac{1}{12}$ $3 \ 4 \ 5 \ 6 \ 7 \ 8 \ 9 \ 10 \ 11}$ Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$	Q26c	$3.6\sin\left(\frac{5\pi}{2}t\right) + 5.1 = 3.3$	
Finds both values of t $ \frac{5\pi}{28}t = -\frac{1}{2} $ Finds both values of t $ \frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6} $ $ t = \frac{98}{15}, \frac{154}{15} $ Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ Finds $\sin\left($		$(28)/(5\pi)$	Correct solution
Finds both values of t $ \frac{5\pi}{28}t = -\frac{1}{2} $ Finds both values of t $ \frac{5\pi}{28}t = \frac{7\pi}{6}, \frac{11\pi}{6} $ $ t = \frac{98}{15}, \frac{154}{15} $ Finds $\sin\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ Finds $\sin\left($		$3.6\sin\left(\frac{3\pi}{22}t\right) = -1.8$	
$t = \frac{33}{15}, \frac{133}{15}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$		$(28)/(5\pi) = 1$	
$t = \frac{33}{15}, \frac{133}{15}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$		$\sin\left(\frac{3\pi}{29}t\right) = -\frac{1}{2}$	Finds both values of t
$t = \frac{33}{15}, \frac{133}{15}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$		$5\pi^{20}7\pi^{2}11\pi^{2}$	
$t = \frac{33}{15}, \frac{133}{15}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$ sin $\left(\frac{5\pi}{28}t\right) = -\frac{1}{2}$		$\frac{1}{28}t = \frac{1}{6}, \frac{1}{6}$	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		98 154	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		$t = \frac{15}{15}, \frac{15}{15}$	$\sin\left(\frac{5\pi}{2}t\right) = -\frac{1}{2}$
9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10 11 Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		10 10	(28) 2
9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10 11 Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		10↑ v	
$\frac{7}{6}$ $\frac{7}{10}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$			
$\frac{7}{6}$ $\frac{7}{10}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$ $\frac{7}{15}$			
$\begin{array}{c} 6\\ 5\\ 4\\ 3\\ 2\\ 1\\ \hline \\ 0\\ \hline 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 & 11 \\ \hline \\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline \\ 10\\ \hline \\ 11\\ \hline \\ 10\\ \hline 10\\ \hline \\ 10\\ \hline $			
$\frac{5}{4}$ $\frac{3}{2}$ $\frac{1}{0}$ $\frac{1}{12}$ $\frac{3}{3}$ $\frac{2}{10}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{12}$ $\frac{1}{15}$			
$\frac{4}{3}$ $\frac{1}{3}$ $\frac{1}{5}$ $\frac{1}$		6	
$\frac{3}{2}$ 1 1 1 1 1 1 1 1 1 1 1 1 1		5	
$\frac{3}{2}$ 1 1 1 1 1 1 1 1 1 1 1 1 1		4	
2 1 1 1 1 1 1 1 2 3 1 1 2 3 4 5 6 7 8 9 10 11 1 1 1 1 1 1 1 1 1 1 1 1			
$\frac{1}{0 + 1 + 2} = \frac{1}{3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11}$ Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$			
Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$			
Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		1	
Time interval in months below 330 is $\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		X	
$\frac{154}{15} - \frac{98}{15} = \frac{56}{15} = 3\frac{11}{15}$ Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$			
Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		Time interval in months below 330 is	
Time interval in months above 330 is $11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		$\frac{154}{110} - \frac{98}{110} = \frac{56}{110} = 3\frac{11}{110}$	
$11.2 - 3\frac{11}{15} = 7\frac{7}{15}$		15 15 15 15 15	
		Time interval in months above 330 is	
		$11.2 - 3\frac{11}{17} = 7\frac{7}{17}$	
		15 15	
			1

	-	
Q27	$y = 3x^{2} + 24x + 33$ $y = 3(x^{2} + 8x) + 33$	2 Marks Correct solution
	$y = 3(x^2 + 8x) + 33$ $y = 3(x^2 + 8x + 16) + 33 - 3 \times 16$	Correct solution
	$y = 3(x + 4)^2 - 15$	1 Mark
		Finds
	$\therefore k = 3, p = -4, q = -15$	$y = 3(x+4)^2 - 15$
Q28	$\left(\frac{3}{7}\right)$	3 Marks
	$A = \int_{-\infty}^{\frac{3}{2}} \left(2 - x - \frac{3}{2x + 3}\right) dx$	Correct solution
		2 Marks
	$A = \left[2x - \frac{x^2}{2} - \frac{3}{2}\ln 2x + 3 \right]^{\frac{3}{2}}$	Correct primitive
		function
	$A = \left[\left(2 \times \frac{3}{2} - \frac{\left(\frac{3}{2}\right)^2}{2} - \frac{3}{2} \ln \left 2 \times \frac{3}{2} + 3 \right \right) \right]$	1 Mark
		Expresses area as
		$\int_{-1}^{\frac{3}{2}} \left(2 - x - \frac{3}{2x + 3}\right) dx$
	$-\left(2 \times (-1) - \frac{(-1)^2}{2} - \frac{3}{2} \ln 2 \times (-1) + 3 \right)$	$\int_{-1}^{2} (2x + 3)^{4x}$
	$A = \left[\left(\frac{15}{8} - \frac{3}{2} \ln 6 \right) - \left(-\frac{5}{2} - \frac{3}{2} \ln 1 \right) \right]$	
	$A = \left(\frac{35}{39} - \frac{3}{2}\ln 6\right) units^{3}$	
	$A = \left(\frac{1}{8} - \frac{1}{2} \ln \theta\right) u \pi u s^{-1}$	
Q29a	(³⁰ , 3, 2, 2, 2, 3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,	2 Marks
	$\int_{0}^{50} kx^{3}(30-x)dx = 1$	Correct solution
	$\frac{1}{k} = \int_{0}^{30} (30x^3 - x^4) dx$	1 Mark
		Finds
	$\left \frac{1}{k} = \left[\frac{30x^4}{4} - \frac{x^5}{5}\right]_0^{30}$	$\frac{1}{k} = \left[\frac{30x^4}{4} - \frac{x^5}{5}\right]^{30}$
		$k \begin{bmatrix} 4 & 5 \end{bmatrix}_0$
	$\left[\frac{1}{k} = \left[\frac{30 \times 30^4}{4} - \frac{30^5}{5} - 0\right]\right]$	
	$\frac{1}{k} = 1215000$	
	$k = \frac{1}{1215000}$	
Q29b	To verify that the median is about 20.586, we need to check that $P(X \le 20.586) \approx 0.5$	1 Mark Correct solution
		concersolution
	$\frac{1}{1215000} \int_{0}^{20.586} (30x^3 - x^4) dx$	
	$=\frac{1}{1215000} \times \left[\frac{30 \times x^4}{4} - \frac{x^5}{5}\right]_0^{20.586}$	
	$\begin{bmatrix} 1215000 & [4 & 5]_0 \\ 1 & [20 \times 20.5964 & 20.5965 &] \end{bmatrix}$	
	$=\frac{1}{1215000} \times \left[\frac{30 \times 20.586^4}{4} - \frac{20.586^5}{5} - 0\right]$	
	= 0.5000	
	≈ 0.5	
Q29c	$P(X > 10) = 1 - P(X \le 10)$	2 Marks
	$P(X > 10) = 1 - \frac{1}{1215000} \int_0^{10} (30x^3 - x^4) dx$	Correct solution
	$r(x > 10) = 1 - \frac{1215000}{1215000} \int_0^1 (30x^2 - x^2) dx$	1 Marti
	$P(X > 10) = 1 - \frac{1}{1215000} \times \left[\frac{30 \times x^4}{4} - \frac{x^5}{5}\right]_0^{10}$	1 Mark Finds $P(X \le 10)$
	$1215000 [4 5]_0$	

	1 [00404 405]	
	$P(X > 10) = 1 - \frac{1}{1215000} \times \left[\frac{30 \times 10^4}{4} - \frac{10^5}{5} - 0\right]$	
	$P(X > 10) = 1 - \frac{1}{1215000} \times 55000$	
	$P(X > 10) = 1 - \frac{11}{243}$	
	$P(X > 10) = \frac{232}{243} = 0.9547 \dots$	
	$P(X > 10) \approx 0.95$	
Q30a	$g'(x) = (1 + x)e^{x+1}$ $g''(x) = 1 \times e^{x+1} + (1 + x) \times e^{x+1}$ $g''(x) = e^{x+1}(1 + 1 + x)$ $g''(x) = (2 + x)e^{x+1}$	1 Mark Correct solution
Q30b	Stationary points where $g'(x) = 0$ $(1 + x)e^{x+1} = 0$	2 Marks Correct solution
	$x = -1$, since $e^{x+1} \neq 0$	
	$g(-1) = -1 \times e^{-1+1} = -1$	1 Mark Finds the stationary
	$g''(-1) = (2-1)e^{-1+1} = 1 > 0$	point (-1, -1)
	\therefore (-1, -1) is a minimum turning point.	
Q30c	Point of inflection where $g''(x) = 0$ $(2 + x)e^{x+1} = 0$	1 Mark Correct solution
	$x = -2$, since $e^{x+1} \neq 0$	correct solution
	$g(-2) = -2 \times e^{-2+1} = -2e^{-1} = -\frac{2}{e}$	
	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	
	Chang concavity at $x = -2$	
	\therefore inflection point at $x = -2$	
	$\left(-2,-\frac{2}{e}\right)$	
Q30d	$g(x) = xe^{x+1}$	2 Marks
	îv /	Correct solution
	4	1 Mark Correct graph with
	3	some key features
	2	
	<u>-6 -5 -4 -3 -2 -1 0/ 1 2</u>	
	$(-2, 2e^{-1})_{(-1, -1)}^{-1}_{-2}$	
	I	

Q31a	Initial velocity at $t = 0$ $v = \frac{6}{\sqrt{5 \times 0 + 4}}$	1 Mark Correct solution
	$v = \frac{6}{\sqrt{4}} = 3$ Initial velocity is $v = 3$ m/s	
Q31b	$v = 6(5t+4)^{-\frac{1}{2}}$ $\ddot{x} = \frac{dv}{dt} = 6 \times -\frac{1}{2} \times 5 \times (5t+4)^{-\frac{3}{2}}$ $\ddot{x} = -15(5t+4)^{-\frac{3}{2}}$	2 Marks Correct solution 1 Mark
	$x = -15(5t + 4)^{-2}$ At $t = 9$ $\ddot{x} = -15 \times (5 \times 9 + 4)^{-\frac{3}{2}}$ $\ddot{x} = -15 \times 7^{-3}$ $\ddot{x} = -\frac{15}{343}$	Correct differentiation
Q31c	$x = \int v dt$ $x = \int 6(5t+4)^{-\frac{1}{2}} dt$	2 Marks Correct solution 1 Mark
	$x = 6 \left[\frac{(5t+4)^{\frac{1}{2}}}{5 \times \frac{1}{2}} \right] + C$	Finds $x = \frac{12}{5}\sqrt{(5t+4)} + C$
	$x = \frac{12}{5}\sqrt{(5t+4)} + C$ t = 0, x = 0 $0 = \frac{12}{5}\sqrt{(0+4)} + C$	
	$C = -\frac{24}{5}$:: $x = \frac{12}{5}\sqrt{(5t+4)} - \frac{24}{5}$	
Q32a	$P = 2r + arcAB$ $P = 2r + r\theta$ $P = r(2 + \theta)$	1 Mark Correct solution
Q32b	$r(2+\theta) = 22$ $r = \frac{22}{(2+\theta)}$	1 Mark Correct solution
	$A = \frac{1}{2}r^{2}\theta$ $A = \frac{1}{2} \times \left(\frac{22}{(2+\theta)}\right)^{2} \times \theta$ $A = \frac{1}{2} \times \frac{484}{(2+\theta)^{2}} \times \theta$	
	$A = \frac{1}{2} \times \frac{(2+\theta)^2}{(2+\theta)^2} \times \theta$ $A = \frac{242\theta}{(2+\theta)^2}$	

Q32c	$dA (2+\theta)^2 \times 242 - 242\theta \times 2(2+\theta)$	3 Marks
	$\frac{dH}{d\theta} = \frac{(2+\theta)^2 + (2+\theta)^4}{(2+\theta)^4}$	Correct solution
	(2+0)	
	$dA 242(2+\theta)(2+\theta-2\theta)$	2 Marks
	$\frac{d\theta}{d\theta} = \frac{1 + (2 + \theta)(2 + \theta - 2\theta)}{(2 + \theta)^4}$	Obtains $\theta = 2$ and
	(2+0)	determines it produces
	$dA = 242(2-\theta)$	a maximum area
	$\frac{dH}{d\theta} = \frac{2 + 2(2 - \theta)}{(2 + \theta)^3}$	
	(2+0)	1 Mark
	$242(2-\theta)$	Correct differentiation
	$\frac{242(2-\theta)}{(2+\theta)^3} = 0$	
	$2 - \theta = 0$	
	$\theta = 2$	
	θ 1 2 3	
	dA = 242 -242	
	$\frac{dA}{d\theta}$ $\frac{242}{27}$ 0 $\frac{-242}{125}$	
	\therefore maximum area occurs at $\theta = 2$	
	242 × 2	
	$A = \frac{242 \times 2}{(2+2)^2}$ $A = \frac{121}{4} unit^2$	
	$(2+2)^2$	
	$A = \frac{121}{4} unit^2$	
	4 This is the maximum area of the sector.	
	וווז וז נווב וומאווועווו מופמ טו נווב צבננטו.	