ACE Examination 2020 Year 12 Mathematics Advanced Yearly Examination Worked solutions and marking guidelines

	Colution	Cuitonia
	Solution	Criteria
L.	$f(x) = 3x^4(4-x)^3$	1 Mark: D
	$f'(x) = 3x^4 \times 3(4-x)^2 \times -1 + (4-x)^3 \times 12x^3$	
	$=3x^3(4-x)^2[-3x+4(4-x)]$	Cala
	$=3x^3(4-x)^2(16-7x)$	
	A moderate negative correlation.	1 Mark: A
3.	$f(x) = 2x^3 + x^2$	1 Mark: A
•	$f'(x) = 6x^2 + 2x$	
	f''(x) = 12x + 2	
	Concave down $f''(x) < 0$	0.1
	f''(x) < 0	Cal
	12x + 2 < 0	
	$x < -\frac{1}{\epsilon}$	
	Amplitude = 1	4 34 7 4
·.		1 Mark: A
	Period = $\frac{2\pi}{\pi}$ = 2	To
	TC .	
5.	у	1 Mark: D
	4 1	
	3+	the
	2	Fm
	1	1
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Sec.
	$\begin{vmatrix} -4 & -3/ & -2 & -1_1 \\ 2 & 2 & 3 & 4 \end{vmatrix}$	J. J.
	/ -2 \	
	/ -3 † \	5
	/ −4 ₩ \	
5.	$z = \frac{(680 - 750)}{} = -2$	1 Mark: B
	35	
	Palana 7 - 2 in 2 F 0/	Cho
	Below Z= -2 is 2.5 %	8.1~
7.	Intersection value is 4.25 (4% and 4 years).	1 Mark: €
/.	Let x be the amount to be invested.	I Maik.
	$FV = 4.25 \times x$	
	$28475 = 4.25 \times x$	than
		1 Chia
	$x = \frac{28475}{4.25}$	
	= \$6700	* .
	∴\$6700 is invested every quarter.	
8.	$z = \frac{x - \mu}{\sigma} = \frac{16 - 11}{2} = 2.5$	1 Mark: B
	$z = \frac{1}{\sigma} = \frac{1}{2} = 2.5$	- N A -
	P(X > 16) = P(Z > 2.5)	(Van
		3h
	= P(Z < -2.5)	

	Solution	Criteria
9.	$2\sin x + \sqrt{3} = 0$	1 Mark: C
	$2\sin x = -\sqrt{3}$	· >>>
	$\sqrt{3}$	1 moron
	$\sin x = -\frac{\sqrt{3}}{2}$	
	$x = \frac{4\pi}{3}, \frac{5\pi}{3}$	
10.		1 Mark: D
10.	1/11/3=e================================	I Mark. D
	- 3l2-[e th2]-(1	
	e +1 = 3	
	ex=2 = 3li2-{2+li2]-1) Octor
	x=h-	
	of Ticles di	
	(luz,3) = 3/2-luz-1	
	Aren of staded tegni = 2/2-1 = 3/2- [(ex-41)dy	z,
	20 - (Cex+11.0x)	
	= 3602- 100	
	1	
Section	II	-
11	$\int \frac{1}{1 - 2x} dx = -\frac{1}{2} \ln 1 - 2x + C$	2 Marks: Correct
	$\int 1 - 2x^{\alpha x} = 2^{\prod_{i=1}^{n}} 2^{x_i}$	answer. 1 Mark: Finds the
		integral as a log
		function.
12(a)	$f(x) = \frac{(x+3)(2x+1)}{\sqrt{x}}$	2 Marks: Correct
		answer.
	$=\frac{2x^2+7x+3}{\sqrt{x}}$	1 Mark: Finds A
		or B or C.
	$=2x^{\frac{3}{2}}+7x^{\frac{1}{2}}+3x^{-\frac{1}{2}}$	
	$\therefore A = 2, B = 7 \text{ and } C = 3$	
12(b)	$f(x) = 2x^{\frac{3}{2}} + 7x^{\frac{1}{2}} + 3x^{-\frac{1}{2}}$	1 Mark: Correct
20 77	$\frac{1}{1} (x) = 2x^{2} + 7x^{2} + 3x^{2}$	answer.
	$f'(x) = 3x^{\frac{1}{2}} + \frac{7}{2}x^{-\frac{1}{2}} - \frac{3}{2}x^{-\frac{3}{2}}$	×3.
13(a)	$P(1 < X \le 3) = 0.4 + 0.2$	1 Mark: Correct
13(b)	$= 0.6$ $\mu = 0 \times 0.1 + 1 \times 0.2 + 2 \times 0.4 + 3 \times 0.2 + 4 \times 0.1$	answer. 2 Marks: Correct
13(0)	= 2	answer.
	$Var(X) = E(X^2) - \mu^2$	1 Marks Charre
	$= 0^{2} \times 0.1 + 1^{2} \times 0.2 + 2^{2} \times 0.4 + 3^{2} \times 0.2 + 4^{2} \times 0.1 - 2^{2}$	1 Mark: Shows some
	= 1.2	understanding
	∴ Variance is 1.2	

14	1	2 Marks: Correct
14	$\int 6x^2 + 2 + x^{-\frac{1}{2}} dx = \frac{6x^3}{3} + 2x + \frac{x^{\frac{1}{2}}}{1} + C$	answer.
	$\int 6x^{2} + 2 + x^{2} dx = \frac{1}{3} + 2x + \frac{1}{1} + C$	1 Mark:
	2	Integrates one
	$= 2x^3 + 2x + 2x^{\frac{1}{2}} + C$	term correctly.
15		2 Marks: Correct
12	$S_n = \frac{a}{1 - r}$	
	1 — r	answer.
	$1.8 = \frac{3}{1-r}$	4 14 3 77 .3
	_ :	1 Mark: Uses the
	1.8 - 1.8r = 3	limiting sum with
	1.8r = -1.2	at least one
	$r = -\frac{1.2}{1.8} = -\frac{2}{3}$	correct value.
	$r = -\frac{1.8}{1.8} = -\frac{1}{3}$	
	\therefore The common ratio is $-\frac{2}{3}$	
16(a)	x-intercept then $y = 0$	2 Marks: Correct
	$0 = (x - 2)(x^2 + 1)$	answer.
	x = 2	
	y-intercept then $x = 0$	1 Mark: Finds
	$y = (0-2)(0^2+1)$	either the x or y
	=-2	intercept.
	: Intercepts are (2, 0) and (0,-2) $f(x) = (x-2)(x^2+1)$	
16(b)		3 Marks: Correct
	$f'(x) = (x-2)2x + (x^2 + 1) \times 1$	answer.
	$=3x^2-4x+1$	
	f''(x) = 6x - 4	2 Marks: Finds
	Stationary points occur when first derivative is equal to zero.	the stationary
	$3x^2 - 4x + 1 = 0$	points.
	(3x - 1)(x - 1) = 0	F
		4.56 1 79 3 .1
	$x = \frac{1}{3} \text{ or } x = 1$	1 Mark: Finds the
	When $x = \frac{1}{3}$ then $y = -\frac{50}{27}$ and	derivative.
	when $x = 1$ then $y = -2$	
	:. Stationary points $(\frac{1}{3}, -\frac{50}{27})$ (1, -2)	
	At $(\frac{1}{3}, -\frac{50}{27})$	
	1	
	$f''(x) = 6 \times \frac{1}{3} - 4 = -2 < 0 \text{ Max}$	
	At (1, -2)	
16(c)	$f''(x) = 6 \times 1 - 4 = 2 > 0 \text{ Min}$	3 Marks: Correct
10(c)	\n \(\lambda \)	
	$y = -f(x)\sqrt{3} \qquad \qquad \int y = f(x)$	answer.
	$y = -f(x) \setminus y = f(x)$	2 Mayles, Finds
	2 +	2 Marks: Finds
		y = f(x) or
	1 †	y = -f(x).
	\bigvee	
	$\langle -$	1 Mark: Finds the
	-2 -1 1 🖄 3	general shape of
	-1 + (1 - 50) /	y = f(x) or
	$\left \left(\frac{1}{3}, -\frac{50}{27} \right) \right $	shows some
	_2	understanding.
	(1,-2)	understanding.
	<u>-</u> /3 ₩	
		1

17	$\frac{\pi}{2}$ $\frac{\pi}{2}$	2 Marks: Correct
	$\int_{\frac{\pi}{4}}^{2} \cos x dx = \left[\sin x \right]_{\frac{\pi}{4}}^{\frac{\pi}{2}}$	answer.
	$= \sin\left(\frac{\pi}{2}\right) - \sin\left(\frac{\pi}{4}\right)$ $= 1 - \frac{1}{\sqrt{2}}$	1 Mark: Correctly integrates.
	$=1-\frac{1}{\sqrt{2}}$	
	$=\frac{\sqrt{2}-1}{\sqrt{2}}$	
	$-\frac{\sqrt{2}}{\sqrt{2}}$	
	$=\frac{2-\sqrt{2}}{2}$	
18(a)	$f(x) = (x^2 - 6x)(x - 3) + 2x$	2 Marks: Correct
	= x[(x-6)(x-3)+2]	answer. 1 Mark: Makes
	$=x(x^2-9x+20)$	some progress.
18(b)	$f(x) = x(x^2 - 9x + 20)$	1 Mark: Correct
	=x(x-4)(x-5)	answer.
18(c)	y 12 	2 Marks: Correct answer.
	8 + /	1 Marsley Change
	4 + /	1 Mark: Shows the general
	\leftarrow	shape of the curve or finds the
	-1 f 1 2 3 4 5 6 7	intercepts.
	$-1\cancel{2}\frac{1}{\cancel{4}}$	
19(a)	$\frac{d}{dx}\ln(x^2+2) = \frac{2x}{x^2+2}$	1 Mark: Correct
	$\int dx^{-1} (x^2 + 2)$	answer.
19(b)	$\frac{d}{dx}\left(\frac{\sin x}{x^2}\right) = \frac{x^2\cos x - \sin x \times 2x}{(x^2)^2}$	2 Marks: Correct
		answer. 1 Mark: Uses the
	$=\frac{x\cos x - 2\sin x}{x^3}$	quotient rule
	λ-	correctly.
20	$A = \int_0^2 x^3 - 5x^2 + 2x + 8dx$	2 Marks: Correct answer.
	3	
	$= \left[\frac{1}{4}x^4 - \frac{5}{3}x^3 + x^2 + 8x\right]_0^2$	1 Mark: Integrates one
	$= \left(\frac{1}{4}(2)^4 - \frac{5}{3}(2)^3 + 2^2 + 8 \times 2\right) - 0$	term correctly.
	$=\frac{32}{3}=10\frac{2}{3}$	
	3 . 3	

21(a)	$\sqrt{ y }$	2 Marks: Correct answer. level of the level of s 1 Mark: Sketches the function or shows some understanding.
21(b)	$P(X \le 1.5)$ $= \frac{1}{2} \times 1 \times 1 + \frac{1}{2} \times 0.5 \times 0.5$ $= 0.625$ 0.5 $y = 1 - x $ 0.5	2 Marks: Correct answer. 1 Mark: Sketches the function or shows some understanding.
22(a)	AP: $\{119, 117, 115,\}$ with $a = 119, d = -2$ and $n = 25$ $T_n = a + (n - 1)d$ $= 119 + (25 - 1) \times (-2)$ $= 71$ $\therefore \text{Sonny's repayment is 71 in the 25th month.}$	2 marks: Correct answer. 1 mark: Uses the formula for the nth term of an AP with one correct value.
22(b)	$S_n = 3200, a = 119 \text{ and } d = -2$ $S_n = \frac{n}{2} [2a + (n-1)d]$ $3200 = \frac{n}{2} \times [2 \times 119 + (n-1) \times (-2)]$ $6400 = n \times (238 - 2n + 2)$ $= 240n - 2n^2$ $2n^2 - 240n + 6400 = 0$ $n^2 - 120n + 3200 = 0$	2 marks: Correct answer. 1 mark: Uses the formula for the sum of an AP with one correct value.
22(c)	$n^2 - 120n + 3200 = 0$ (n - 80)(n - 40) = 0 n = 40 or $n = 80When n = 40 then T_{40} = 119 + (40 - 1) \times (-2) = $41When n = 80 then T_{80} = 119 + (80 - 1) \times (-2) = -$39\therefore n = 80 is not a sensible answer as the repayments are -$39.$	2 marks: Correct answer. 1 mark: Solves the quadratic equation.
23	$x^{2} = 2^{2} + 3^{2}$ $x = \sqrt{13}$ $\sin\theta = \frac{2}{\sqrt{13}}$	2 Marks: Correct answer. 1 Mark: Finds the value of x or makes some progress.

24(a)	dy	1 Mark: Correct
	$\frac{dy}{dx} = x^3 + 2x - 7$ $\frac{d^2y}{dx^2} = 3x^2 + 2$	answer.
	$\frac{d^2y}{dx^2} = 3x^2 + 2$	
	dx^2	
24(b)	Since $x^2 \ge 0$ (for all values of x) then $3x^2 \ge 0$	1 Mark: Correct
	$\left \therefore \frac{d^2 y}{dx^2} \ge 2 \right $	answer.
	$\int dx^2 - dx$	
24(c)	Finding the anti-derivative.	2 Marks: Correct
	$y = \frac{x^4}{4} + x^2 - 7x + C$	answer.
	†	1 Mark: Finds the
	P(2, 4) is on the curve and satisfies the equation.	anti-derivative.
	$4 = \frac{2^4}{4} + 2^2 - 14 + C$	
	C = 10	
	$\therefore y = \frac{x^4}{4} + x^2 - 7x + 10$	
	4	
24(d)	Gradient of the tangent at $P(2, 4)$	2 Marks: Correct
	$m = \frac{dy}{dx} = 2^3 + 2 \times 2 - 7 = 5$	answer.
	dx Gradient of the normal at $P(2, 4)$	1 Mark: Finds the
	$m_1 m_2 = -1$	gradient of the
	$m = -\frac{1}{r}$	tangent at $P(2, 4)$
	<u> </u>	
	Equation of the normal at $P(2, 4)$	
	$y - y_1 = m(x - x_1)$ $y - 4 = -\frac{1}{5}(x - 2)$	
	$y - 4 = -\frac{\pi}{5}(x - 2)$	
	$\therefore x + 5y - 22 = 0$	
25(a)	95% of the data lie within two standard deviations of the mean.	1 Mark: Correct
	42 hours is a z-score of -2 and 54 hours has a z-score of 2.	answer.
	The mean is midway between 42 and 54 hours.	
	∴ Mean is 48 hours.	
25(b)	There are 4 standard deviations between 42 and 54 hours.	1 Mark: Correct
	Standard deviation = 54 - 42	answer.
	Standard deviation = $\frac{54 - 42}{4}$	
	= 3 hours	
25(c)	To find the z-score of 51 and 57	2 Marks: Correct
	$z = \frac{x - \bar{x}}{s} = \frac{51 - 48}{3} = 1$	answer.
		4.46 3.77
	$z = \frac{x - \bar{x}}{s} = \frac{57 - 48}{3} = 3$	1 Mark: Uses the z-score formula
		or shows some
	Percentage = $\frac{99.7\%}{2} - \frac{68\%}{2}$	understanding.
	= 15.85%	
	\therefore 15.85% have sleep between 51 and 57 hours of sleep per week	

26	Width of the strip	3 Marks: Correct
	$h = \frac{b-a}{n} = \frac{420-0}{6} = 70$	answer.
	$n = \frac{1}{n} = \frac{1}{6} = 70$	
	Top half of the lake.	2 Marks: Makes
	$A \approx \frac{h}{2} [y_0 + y_6 + 2(y_1 + y_2 + y_3 + y_4 + y_5)]$	significant
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	progress.
	$\approx \frac{70}{2} [30 + 30 + 2(40 + 60 + 80 + 60 + 40)]$	1 Mark: Uses the
	≈ 21 700	trapezoidal rule
	Area of the entire lake	with at least one
	$A \approx 2 \times 21700 \approx 43400 \text{ m}$	correct value.
	∴ Area of the lake is about 43 400 metres.	
27(a)	Investment = $400 \times 12 \times 45$	1 Mark: Correct
2. (3)	= \$216 000	answer.
	John contributed \$216 00 over the 45 years.	
27(b)	0.06	2 Marks: Correct
	$r = \frac{0.00}{12} = 0.005\%$ per month	answer.
	After 1 month	
	$A_1 = (400 \times 1.005^1)$	1 Mark: Makes
	After 2 months	some progress
	$A_2 = (400 \times 1.005^2) + (400 \times 1.005^1)$	towards the
	After 45 years (540 months)	solution.
	$A_{540} = 400 \times 1.005^{540} + (400 \times 1.005^{539}) \dots + (400 \times 1.005^{1})$	
	Use the formula for the sum of a GP	
	$A_{540} = 400 \times \frac{1.005(1.005^{540} - 1)}{1.005 - 1}$	
	E Company of the Comp	
	= \$1 107 909.03	
	∴ John's investment is worth \$1 107 909.03 after 45 years.	
27(c)	$FV = PV(1+r)^n$	2 Marks: Correct
	$300\ 000 = PV(1+0.08)^{10}$	answer. 1 Mark: Uses the
	$PV = 138\ 958.0464$	FV formula with
	≈ \$138 958	one correct
	∴ John needs to reinvest \$138 958.	value.
28	$\frac{dP}{dt} = 1200a^{0.3t}$	3 Marks: Correct
	$\frac{dP}{dt} = 1200e^{0.3t}$	answer.
	$P = \frac{1200}{0.3}e^{0.3t} + C$	234 7 34 3
	0.3	2 Marks: Makes
	$P = 4000e^{0.3t} + C$	significant
	Given $P = 5000$ when $t = 1$	progress.
	$5000 = 4000e^{0.3t} + C$	1 Mark: Finds the
	$C = -399.4352 \dots \approx -399.4$	anti-derivative of
	To find t when $P = 100000$	the differential
	$P = 4000e^{0.3t} - 399.4352 \dots$	equation.
	$100\ 000 = 4000e^{0.3t} - 399.435\dots$	
	$e^{0.3t} = 25.099$	
	ln25.099 = 0.3t	
	t = 10.742	
	≈ 11	
	∴The nest reaches a viable stage after 11 months.	
1	1	1

29(a)	Amplitude = 1 Period = $\frac{2\pi}{1} = 2\pi$	2 Marks: Correct answer. 1 Mark: Finds the general shape of the curve or makes some progress.
	$\frac{\pi}{4} \qquad \frac{\pi}{2} \qquad \frac{3\pi}{4} \qquad \pi$	
29(b)	The particle is a rest when $v = 0$ or $\frac{dx}{dt} = 0$ $\therefore t = 0, \frac{\pi}{2}, \pi$ \therefore Position of the particle at these times: $x = 0, 2, 0$	2 Marks: Correct answer. 1 Mark: Finds the times or positions.
29(c)	$x = 1 - \cos 2t$ $v = \frac{dx}{dt} = 2\sin 2t$ At $t = \frac{\pi}{4}$. $v = 2\sin \left(2 \times \frac{\pi}{4}\right)$ $= 2 \text{ m/s}$ $\therefore \text{Velocity of the particle is 2 m/s.}$	1 Mark: Correct answer.
29(d)	$2\sin 2t = 1$ $\sin 2t = \frac{1}{2}$ $2t = \frac{\pi}{6}, \frac{5\pi}{6}$ $t = \frac{\pi}{12}, \frac{5\pi}{12}$ Using the graph $\therefore \frac{\pi}{12} < t < \frac{5\pi}{12}$	1 Mark: Correct answer.

30	Minimum value occurs when $\frac{dy}{dx} = 0$	3 Marks: Correct answer.
	$\frac{dy}{dx} = 4x - \frac{0.5}{\frac{x}{2}}$	answer.
		2 Marks: Shows
	$0 = 4x - \frac{1}{x}$	the minimum value at
	$4x^2 = 1$	$\left(\frac{1}{2}, \ln 4 - 3\frac{1}{2}\right)$
	$x^2 = \frac{1}{4}$	without testing
	$x = \pm \frac{1}{2}$	for a minima
	Since x cannot take a negative value, $x = 0.5$.	1 Mark: Finds the
	$y = 2(0.5)^2 - \ln\left(\frac{0.5}{2}\right) - 4 = \ln 4 - 3\frac{1}{2}$	derivative.
	2	
	$\left \div \left(\frac{1}{2}, \ln 4 - 3 \frac{1}{2} \right) \right $	-
	Check if a minima	
	$\frac{d^2y}{dx^2} = 4 + \frac{1}{x^2}$	
	When $x = 0.5$	
	$\frac{d^2y}{dx^2} = 4 + \frac{1}{0.5^2} = 8 > 0 \text{ Minima}$	
	dx^2 0.52	
31	To find the expected value or mean	2 Marks: Correct
	$\int_0^\infty x f(x) dx = \int_0^1 x (x^3 - x + 4) dx$	answer.
	J	1 Mark: shows
	\int_{-1}^{1}	
	$= \int_0^1 x^4 - x^2 + 4x dx$	some understanding.
		some
	$= \int_0^1 x^4 - x^2 + 4x dx$ $= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2 \right]_0^1$	some
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$	some
		some
226.3	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$	some understanding.
32(a)	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$	some
32(a)	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124 \ 103.392$	some understanding.
32(a)	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$	some understanding.
32(a) 32(b)	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124 \cdot 103.392$ $\approx \$124 \cdot 103.39$	some understanding.
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124\ 103.392$ $\approx \$124\ 103.39$ $r = \frac{0.078}{12} = 0.0065 n = 4 \times 12 = 48$ Intersection value is 41.11986	some understanding. 1 Mark: Correct answer.
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124\ 103.392$ $\approx \$124\ 103.39$ $r = \frac{0.078}{12} = 0.0065 n = 4 \times 12 = 48$ Intersection value is 41.11986 Let the monthly repayment be x .	1 Mark: Correct answer. 2 marks: Correct answer.
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124\ 103.392$ $\approx \$124\ 103.39$ $r = \frac{0.078}{12} = 0.0065 n = 4 \times 12 = 48$ Intersection value is 41.11986	some understanding. 1 Mark: Correct answer. 2 marks: Correct answer. 1 mark: Finds the intersection
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124 \ 103.392$ $\approx \$124 \ 103.39$ $r = \frac{0.078}{12} = 0.0065 n = 4 \times 12 = 48$ Intersection value is 41.11986 Let the monthly repayment be x. $PV = 41.11986 \times x$ $27 \ 000 = 41.11986 \times x$	1 Mark: Correct answer. 2 marks: Correct answer. 1 mark: Finds the intersection value or shows
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124 103.392$ $\approx $124 103.39$ $r = \frac{0.078}{12} = 0.0065 n = 4 \times 12 = 48$ Intersection value is 41.11986 Let the monthly repayment be x. $PV = 41.11986 \times x$ $27 000 = 41.11986 \times x$ $x = \frac{27 000}{41.11986}$	some understanding. 1 Mark: Correct answer. 2 marks: Correct answer. 1 mark: Finds the intersection
	$= \left[\frac{x^5}{5} - \frac{x^3}{3} + 2x^2\right]_0^1$ $= \frac{28}{15} = 1\frac{13}{15}$ Intersection value is 38.78231 (0.0075 and 46 months) $PV = 38.78231 \times 3200$ $= 124 \ 103.392$ $\approx \$124 \ 103.39$ $r = \frac{0.078}{12} = 0.0065 n = 4 \times 12 = 48$ Intersection value is 41.11986 Let the monthly repayment be x. $PV = 41.11986 \times x$ $27 \ 000 = 41.11986 \times x$	1 Mark: Correct answer. 2 marks: Correct answer. 1 mark: Finds the intersection value or shows some

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	33(a)	The state of the s	ELECTROPHE STATE OF THE STATE O
$H = 1.19t - 0.85$ $= 1.19 \times 5 - 0.85$ $\approx 5.1 \text{ m}$ $Height of the tree after 5 years is 5.1 \text{ metres.}$ $33(d) \text{When } H = 20 \text{ m}$ $H = 1.19t - 0.85$ $20 = 1.19 \times t - 0.85$ $1.19t = 20.85$ $t \approx 17.5 \text{ years}$ $\text{It takes } 17.5 \text{ years for the tree to reach a height of } 20 \text{ metres.}$ $33(e) \text{Strong positive linear association}$ $\text{Question } (C) \text{ involves interpolation. Very reliable.}$ $\text{Question } (D) \text{ involves extrapolation. Less reliable.}$ $34(a) \text{Mark: Correct answer.}$ $1 \text{ Mark: Draws the general shape of the curve.}$ $1 \text{ Mark: Draws the general shape of the curve.}$ $1 \text{ Mark: Correct answer.}$ $1 \text{ Mark: Substitutes 10 into the equation.}$	33(b)	=BX+A	
$H = 1.19t - 0.85$ $20 = 1.19 \times t - 0.85$ $1.19t = 20.85$ $t \approx 17.5 \text{ years}$ $\therefore \text{ It takes } 17.5 \text{ years for the tree to reach a height of } 20 \text{ metres.}$ $33(e) \text{ Strong positive linear association}$ $Question (C) \text{ involves interpolation. Very reliable.}$ $Question (D) \text{ involves extrapolation. Less reliable.}$ $34(a) y$ 4 $2 \text{ Marks: Correct answer.}$ $1 \text{ Mark: Draws the general shape of the curve.}}$ $1 \text{ Mark: Draws the general shape of the curve.}}$ $1 \text{ Mark: Correct answer.}$ $1 \text{ Mark: Correct answer.}}$ $1 \text{ Mark: Correct answer.}}$ $2 \text{ Mark: Correct answer.}$ $1 \text{ Mark: Correct answer.}}$ $2 \text{ Mark: Correct answer.}}$ $34(c) \text{ The high tide has height 4 metres above the mean height.}}$ $1 \text{ Mark: Correct answer.}}$ $2 \text{ Marks: Correct answer.}}$ $1 \text{ Mark: Substitutes } 10 \text{ into the equation.}}$	33(c)	H = 1.19t - 0.85 = 1.19 × 5 - 0.85 $\approx 5.1 \text{ m}$	
Question (C) involves interpolation. Very reliable. 34(a) 34(a) 34(b) High tide occurs when $h(t) = 4$ Using the graph $t = 4 \text{ or } t = 20$ 34(c) The high tide has height 4 metres above the mean height. 34(d) $h(t) = 4\sin\left(\frac{\pi}{8}t\right)$ $h(8) = 4\sin\left(\frac{\pi \times 10}{8}\right) = 4\sin\left(\frac{5\pi}{4}\right)$ $= -2.8284 \dots$ ≈ -2.8	33(d)	H = 1.19t - 0.85 $20 = 1.19 \times t - 0.85$ 1.19t = 20.85 $t \approx 17.5 \text{ years}$	
answer. 1 Mark: Draws the general shape of the curve. 34(b) High tide occurs when $h(t) = 4$ Using the graph $t = 4 \text{ or } t = 20$ 1 Mark: Correct answer. 1 Mark: Correct answer. 1 Mark: Correct answer. 2 Mark: Correct answer. 34(d) $h(t) = 4\sin\left(\frac{\pi}{8}t\right)$ $h(8) = 4\sin\left(\frac{\pi}{8}t\right)$ $= -2.8284 \dots$ ≈ -2.8	33(e)	Question (C) involves interpolation. Very reliable.	
Using the graph $\therefore t = 4$ or $t = 20$ 34(c) The high tide has height 4 metres above the mean height. 1 Mark: Correct answer. $h(t) = 4\sin\left(\frac{\pi}{8}t\right)$ $h(t) = 4\sin\left(\frac{\pi}{8}t\right)$ $h(t) = 4\sin\left(\frac{\pi \times 10}{8}\right) = 4\sin\left(\frac{5\pi}{4}\right)$ $= -2.8284$ ≈ -2.8	34(a)	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	answer. 1 Mark: Draws the general shape of the
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$h(8) = 4\sin\left(\frac{\pi \times 10}{8}\right) = 4\sin\left(\frac{5\pi}{4}\right)$ $= -2.8284 \dots$ ≈ -2.8 1 Mark: Substitutes 10 into the equation.	34(c)	The high tide has height 4 metres above the mean height.	
$= -2.8284$ ≈ -2.8 Substitutes 10 into the equation.	34(d)	$h(t) = 4\sin\left(\frac{\pi}{8}t\right)$	
:. Water is about 2.8 metres below mean height.		= -2.8284 ≈ -2.8	
		Water is about 2.8 metres below mean height.	