

Question		Answer	Marks	Guidance
1		$\frac{1}{2}x^{-\frac{1}{2}} - 3x^{-2}$ oe; isw	B3 [3]	need not be simplified B2 for one term correct ignore + c if B0 allow M1 for either $x^{1/2}$ or $x^{-1}$ seen before differentiation deduct one mark for extra term in $x$
2		(5), 8, 11, (14),...isw $a = 5$ and $d = 3$ soi $S_{50} = \frac{50}{2}(2 \times 5 + (50 - 1) \times 3)$ oe 3925	B1 B1 M1 A1 [4]	if M0, SC1 for use of $a = 8$ and obtaining 4075 if M0, award B2 if 3925 is obtained from summing individual terms or if unsupported
3	(i)	$9.8^2 + 6.4^2 - 2 \times 9.8 \times 6.4 \times \cos 53.4$ $9.8^2 + 6.4^2 - 74.79...$ [= 62.2...] 7.887... or 7.89 or 7.9	M1 M1 A1 [3]	for evidence of correct order of operations used; may be implied by correct answer if M0, B3 for 7.89 or more precise www 6.89 implies M0 262.4368 implies M1 (calc in radian mode), (NB $\sqrt{262.436..}=16.199...$ ) NB $9.8\sin 53.4 = 7.87$
3	(ii)	$\frac{1}{2} \times 9.8 \times 7.3 \times \sin (180 - 53.4)$ oe seen 28.716...or 28.72 or 28.7 or 29 isw	M1 A1 [2]	or $\sin 53.4$ used; may be embedded if M0, B2 for 28.7 or more precise www may be split into height = $9.8 \times \sin 53.4$ then Area = $\frac{1}{2} \times 7.3 \times \text{height}$
4	(i)	(6, 9)	2 [2]	1 for each co-ordinate SC0 for (6, 3)
4	(ii)	(1.5, 3)	2 [2]	1 for each co-ordinate SC0 for (6, 3)
5		$45 = \frac{1}{2} r^2 \times 1.6$ oe $r^2 = 90/1.6$ oe $r = 7.5$ or exact equivalent cao  (their 7.5) $\times 1.6$ 27	M1 M1 A1  M1 A1 [5]	$45 = \pi r^2 \times \frac{91.673...}{360}$ or B3 www  $2\pi \times (\text{their } r) \times \frac{91.673...}{360}$ or B2 www allow recovery to 7.5 if working in degrees, but A0 for (eg) 7.49 12 implies M1

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6		gradient = 3 seen	B1	may be embedded	condone omission of base throughout NB may recover from eg $Y = 3X + 2$ or $\log_{10} \frac{y}{x^3} = 2$ or $\log_{10} y = \log_{10} 100x^3$
		$\log_{10} y - 5 = (\text{their } 3)(\log_{10} x - 1)$ or using (5, 17)	M1	or $\log_{10} y = 3 \log_{10} x + c$ and substitution of (1, 5) or (5, 17) for $\log_{10} x$ and $\log_{10} y$	
		$\log_{10} y = 3 \log_{10} x + 2$ oe	A1		
		$y = 10^{3\log_{10} x + 2}$ oe	M1	or $\log_{10} y = \log_{10} x^3 + \log_{10} 100$	
		$y = 100x^3$	A1		
			[5]		
7		$\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}$	M1*	may appear later B0 if from $y = (6x^{\frac{1}{2}} - 5)x + c$	condone "+ c" not appearing until substitution
		$4x^{\frac{3}{2}}$	A1		
		$-5x + c$	B1		
		substitution of (4, 20)	M1dep*		
		[y =] $4x^{1.5} - 5x + 8$ or $c = 8$ isw	A1		
			[5]		
8		0.775397.. soi	M1	or 44.427..°	if any of final answers not given to three sf deduct 1 mark from total A marks  *if final answers in degrees deduct 1 from total A marks ignore extra values outside range if four correct answers in degrees or radians, deduct 1 for extra values in range
		0.388, 1.18, 3.53, 4.32	A4	A1 each value	
		in degrees: 22.2, 67.8, 202, 248*		if A0 then B1 for at least two of 2.366..., 7.058..., 8.649... for $2\theta$ or all of 135.57..., 404.427..., 495.57...	
			[5]		

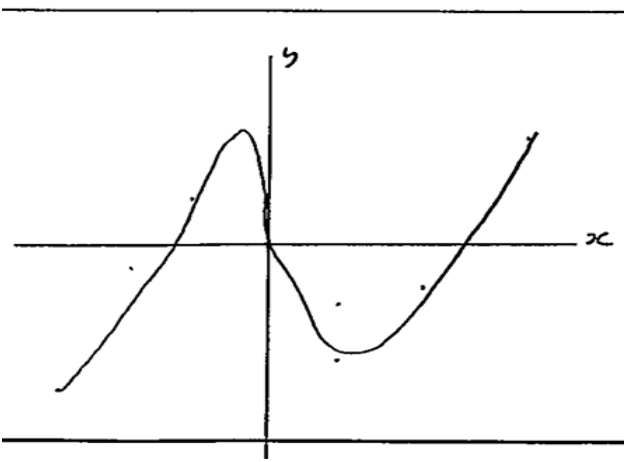
Question		Answer	Marks	Guidance	
9	(i)	$\frac{1}{2} \times 0.2 (0 + 0 + 2(0.5 + 0.7 + 0.75 + 0.7 + 0.5))$ $[=0.63]$  (their 0.63) $\times 50$ 31.5	M3   M1 A1 [5]	M2 if one error, M1 if two errors condone omission of zeros or M3 for $0.05 + 0.12 + 0.145 + 0.145 + 0.12 + 0.05$ may be unsimplified, must be summed  basic shape of formula must be correct must be 6 strips M0 if brackets omitted, but allow recovery M0 if $h = 1$ or $1.2$ Area = 6.3 and 0.53 imply M0	
9	(ii)	(A)	$3.8 \times 0.2^4 - 6.8 \times 0.2^3 + 7.7 \times 0.2^2 - 4.2 \times 0.2$  0.01968 cao isw	M1  A1 [2]	$\pm 0.58032$ implies M1  or B2 if unsupported  condone one sign error  allow $- 0.01968$
9	(ii)	(B)	$\frac{3.8x^5}{5} - \frac{6.8x^4}{4} + \frac{7.7x^3}{3} - \frac{4.2x^2}{2} + c$  F(0.9) [ $- F(0)$ ] 50 $\times$ their $\pm F(0.9)$ 24.8 to 24.9 cao	M2   M1* M1dep* A1 [5]	M1 for two terms correct excluding $c$ condone omission of $c$  as long as at least M1 awarded  accept 2.56 to 2.57 for coefficient of $x^3$ allow M1 if all signs reversed  NB $F(0.9) = - 0.496\dots$

Question		Answer	Marks	Guidance	
10	(i)	$y' = 3x^2 - 5$ their $y' = 0$  (1.3, -4.3) cao (-1.3, 4.3) cao	M1 M1  A1 A1 <b>[4]</b>	or A1 for $x = \pm\sqrt{\frac{5}{3}}$ oe soi allow if not written as co-ordinates if pairing is clear	ignore any work relating to second derivative
10	(ii)	crosses axes at (0, 0)  and $(\pm\sqrt{5}, 0)$ sketch of cubic with turning points in correct quadrants and of correct orientation and passing through origin x-intercepts $\pm\sqrt{5}$ marked	B1 B1 B1  B1 <b>[4]</b>	condone x and y intercepts not written as co-ordinates; may be on graph $\pm(2.23 \text{ to } 2.24)$ implies $\pm\sqrt{5}$  may be in decimal form ( $\pm 2.2\dots$ )	See examples in Appendix  must meet the x-axis three times B0 eg if more than 1 point of inflection
10	(iii)	substitution of $x = 1$ in $f'(x) = 3x^2 - 5$  -2 $y - -4 = (\text{their } f'(1)) \times (x - 1)$ oe $-2x - 2 = x^3 - 5x$ and completion to given result wwww use of Factor theorem in $x^3 - 3x + 2$ with -1 or $\pm 2$  $x = -2$ obtained correctly	M1  A1 M1* M1dep*  M1  A1 <b>[6]</b>	or $-4 = -2 \times (1) + c$  or any other valid method; must be shown	sight of -2 does not necessarily imply M1: check $f'(x) = 3x^2 - 5$ is correct in part (i)  eg long division or comparing coefficients to find $(x - 1)(x^2 + x - 2)$ or $(x + 2)(x^2 - 2x + 1)$ is enough for M1 with both factors correct NB M0A0 for $x(x^2 - 3) = -2$ so $x = -2$ or $x^2 - 3 = -2$ oe

Question		Answer	Marks	Guidance
11	(i)	$ar = 6$ oe $\frac{a}{1-r} = 25$ oe $25 = \frac{a}{1-\frac{6}{a}}$ $a^2 - 25a + 150 [= 0]$ $a = 10$ obtained from formula, factorising, Factor theorem or completing the square $a = 15$ $r = 0.4$ and $0.6$	B1 B1  M1  A1 A1  A1 A1  [7]	must be in $a$ and $r$ must be in $a$ and $r$  or $\frac{6}{r} = 25(1-r)$  or $25r^2 - 25r + 6 [= 0]$ $r = 0.4$ and $r = 0.6$  $a = 15$ $a = \frac{6}{0.6} = 10$ oe  NB assuming $a = 10$ earns M0  All signs may be reversed  if M0, B1 for $r = 0.4$ <b>and</b> $0.6$ and B1 for $a = 15$ by trial and improvement mark to benefit of candidate
11	(ii)	$10 \times (3/5)^{n-1}$ and $15 \times (2/5)^{n-1}$ seen  $15 \times 2^{n-1} : 10 \times 3^{n-1}$ or $3 \times \frac{2^{n-1}}{5^{n-1}} : 2 \times \frac{3^{n-1}}{5^{n-1}}$  $3 \times 2^{n-1} : 2 \times 3^{n-1}$	M1  M1  A1  [3]	  may be implied by $3 \times 2^{n-1} : 2 \times 3^{n-1}$  and completion to given answer www  condone ratio reversed  condone ratio reversed

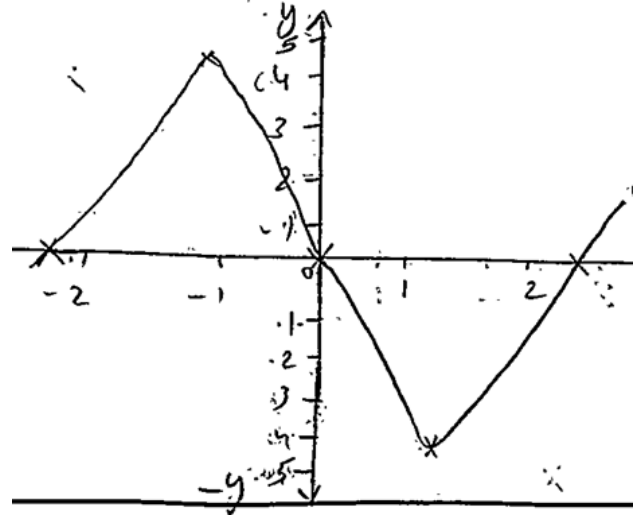
Appendix: examples for Question 10(ii)

Example 1



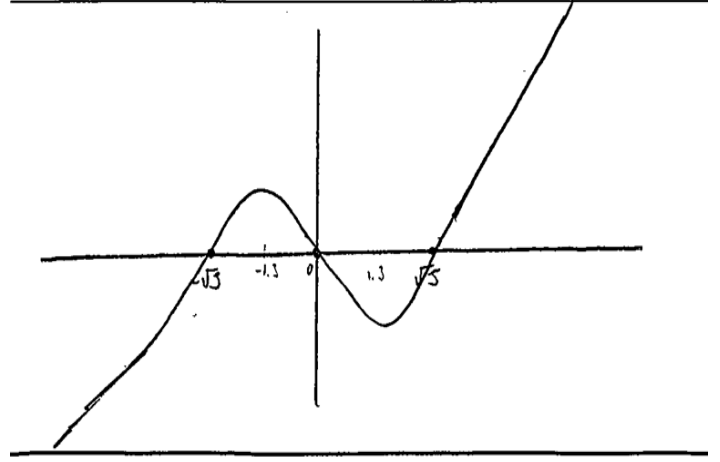
3<sup>rd</sup> B1 BOD inflection

Example 2



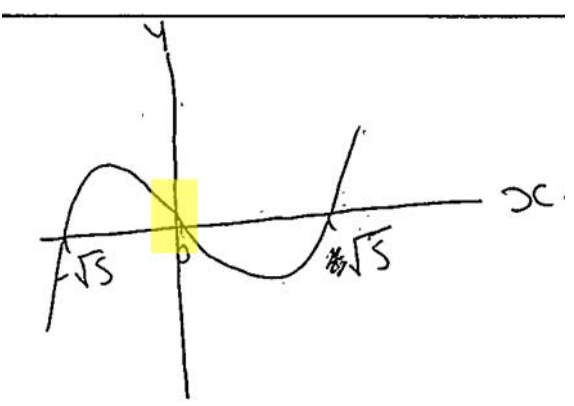
3<sup>rd</sup> B1 BOD Shape

Example 3



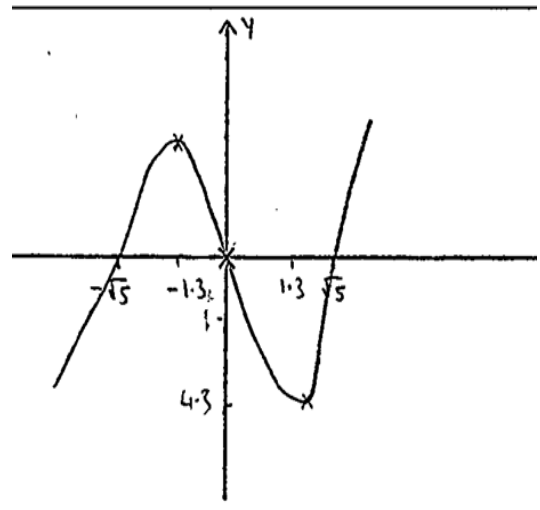
3<sup>rd</sup> B1 BOD Point of inflection on left

Example 4



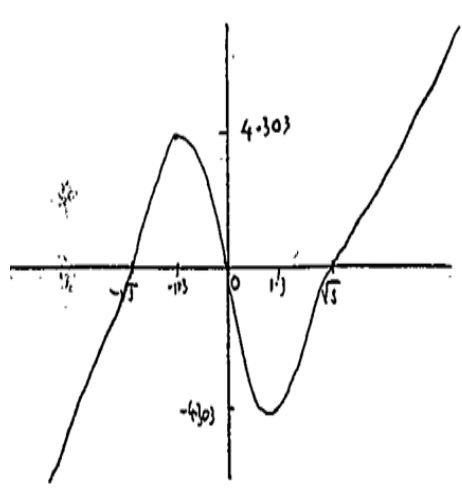
Clearly does not pass through origin  
3<sup>rd</sup> B0

Example 5



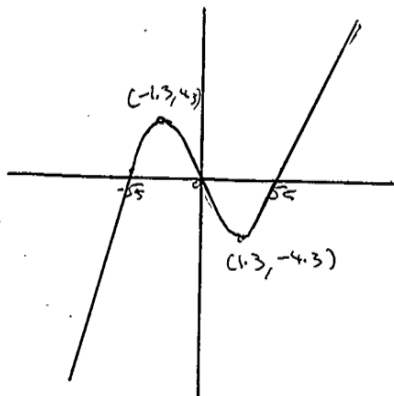
3<sup>rd</sup> B1

Example 6



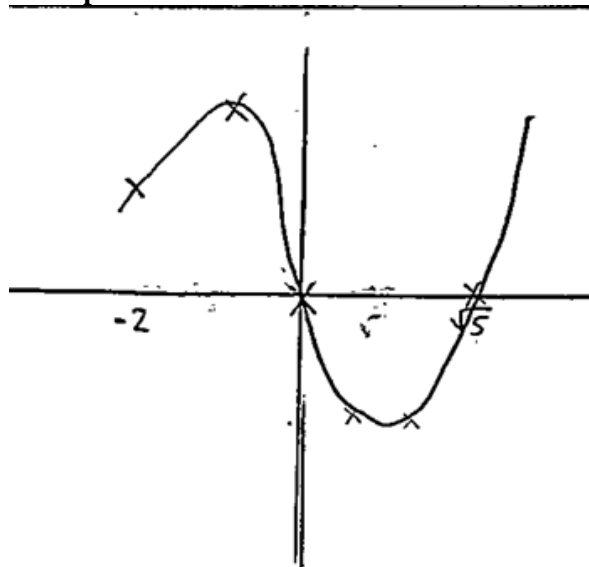
3<sup>rd</sup> B1 condone RHS

Example 7



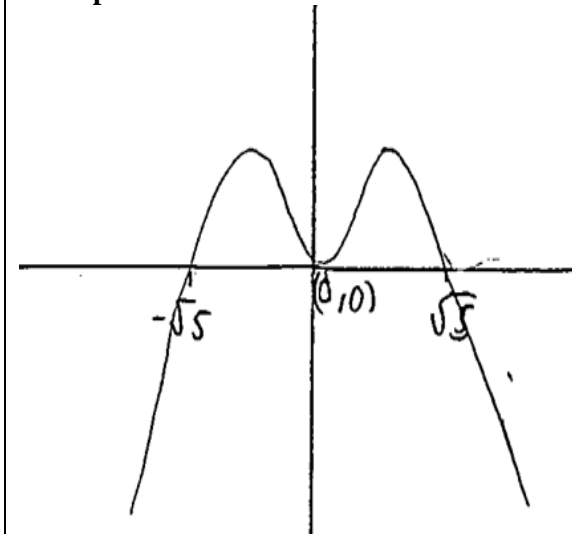
3<sup>rd</sup> B1 condone extreme ends ruled

Example 8



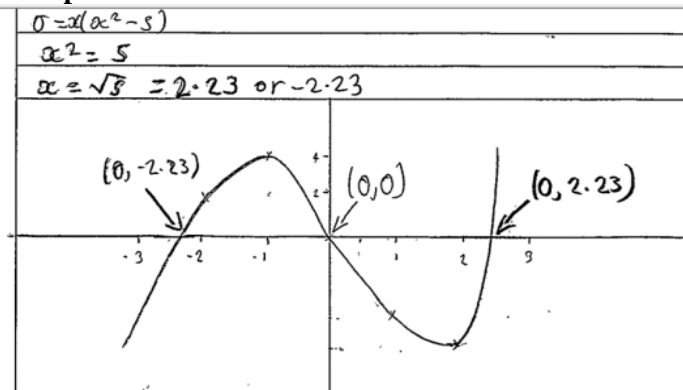
3<sup>rd</sup> B0 doesn't meet x-axis 3 times

Example 9



4<sup>th</sup> B1 is earned in spite of the curve not being a cubic

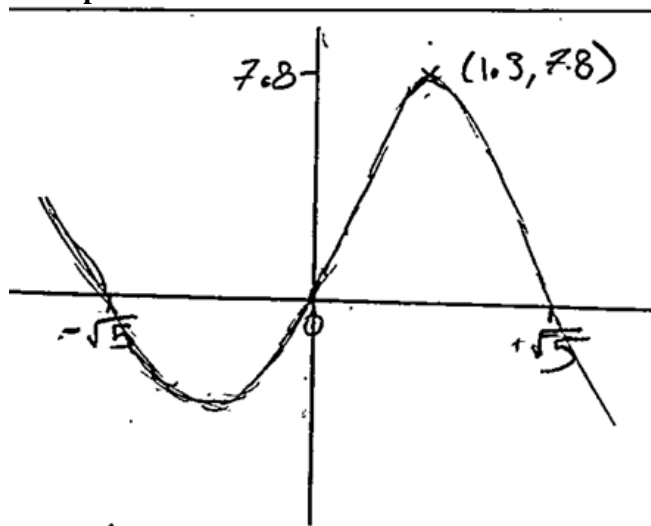
Example 10



x-intercepts: co-ordinates reversed but condone this as candidates who write -2.23, 2.23 only would not be penalised

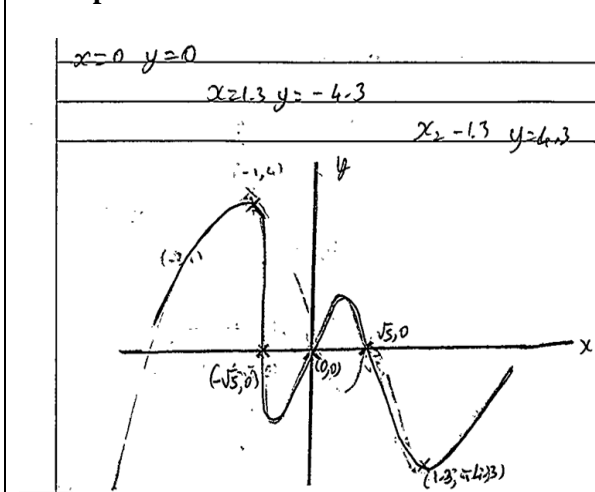
4<sup>th</sup> B1

Example 11



(3<sup>rd</sup> B0: incorrect orientation) 4<sup>th</sup> B1

Example 12



4<sup>th</sup> B1 earned.