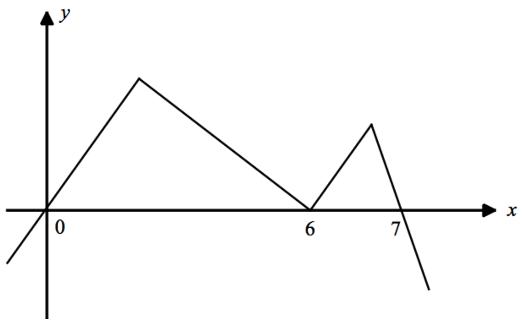
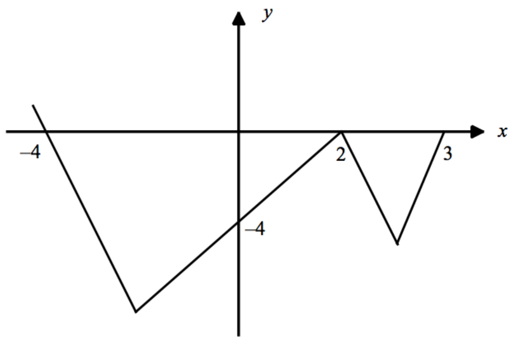
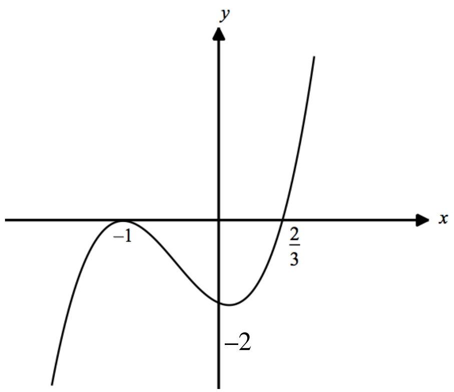
A Level
AS Maths

Bronze Set A, Paper 1 (Edexcel version)

Question	Solution	Partial Marks	Guidance
1 (a)	$\dfrac{2x^3}{3}-\dfrac{5x^{\frac{3}{2}}}{\frac{3}{2}}+x+c$ $\dfrac{2}{3}x^3-\dfrac{10}{3}x^{\frac{3}{2}}+x+c$	M1 A1 A1 A1 **[4]**	Attempts to integrate at least one term (correct method to integrate an incorrect representation of $5\sqrt{x}$ can still score the M1) One term integrated correctly (need not be simplified) All three terms integrated correctly (need not be simplified) Fully correct integration with all terms simplified and a constant of integration seen. Final answer, no ISW
1 (b)	$\left[\dfrac{2}{3}(1)^3-\dfrac{10}{3}(1)^{\frac{3}{2}}+1\right]-0$ $=-\dfrac{5}{3}$	M1 A1 **[2]**	Substitutes limits correctly into their integral Obtains correct answer. Answer only is M1 A1. Final answer
2	$x^2+(x+1)^2=1$ $\Rightarrow 2x^2+2x=0$ $\Rightarrow x=0,\ x=-1$ When $x=0$, $2y=1\Rightarrow y=\dfrac{1}{2}$ When $x=-1$, $2y=0\Rightarrow y=0$ so solutions are (0, 1/2) and (–1, 0)	M1* A1 M1(dep*) A1 **[4]**	Method to eliminate either x or y from equations Correct values of x or y Uses their x or y to find the values of y or x Obtains the correct solutions. ISW

3 (a)		B1 B1 B1 **[3]**	Horizontal translation of 4 units left or right Graph intersects the origin Intersects the x axis at 6 and 7
3 (b)		B1 B1 B1 **[3]**	Correct shape of the graph Correct x intersections Correct y intersections
4 (a)	$kx+(1-k)y=5 \Rightarrow y=\frac{5}{1-k}-\frac{kx}{1-k}$ so gradient is $-\frac{k}{1-k}$	M1 A1 **[2]**	Attempts to re-arrange for y Correct answer oe. Answer only is 2/2.

4 (b)	Gradient is $\frac{k-4}{3-1}=\frac{k-4}{2}$	B1 **[1]**	Correct gradient oe
4 (c)	By perpendicularity, $\frac{k-4}{2}\times\frac{-k}{1-k}=-1$ $\Rightarrow \frac{-k(k-4)}{2(1-k)}=-1$ $\Rightarrow -k^2+4k=-2+2k$ $\Rightarrow k^2-2k-2=0$ **AG**	M1* M1(dep*) A1 **[3]**	Forms a correct equation Attempts to rearrange to form a 3TQ Convincing proof with no errors seen. Answer given.
4 (d)	$k=1\pm\sqrt{3}$	B1 **[1]**	Cao
5 (a)	$3(-1)^3+a(-1)^2-(-1)-2=0$ $\Rightarrow -3+a+1-2=0$ $\Rightarrow a=4$	M1 A1 **[2]**	Uses the factor theorem to form a correct equation in a Correct value of a
5 (b)	The other factor is $3x^2+x-2$ $3x^2+x-2=0$ $\Rightarrow (3x-2)(x+1)=0$ $\Rightarrow x=-1,\frac{2}{3}$ so the solutions are $x=-1,\ x=\frac{2}{3}$	M1 A1 A1 **[3]**	Method to find the other quadratic factor Correct quadratic factor Correct solutions. Only one solution given is A0. Additional solutions given is A0. Answer only is 0/3.

5 (c)		B1 B1 B1 **[3]**	Correct shape: positive cubic and repeated root at –1 Correct *x* intersections ft their (b) Correct *y* intersection at –2
6 (a)	$14500\,e^{-0.37(0)}+1500$ $=14500+1500$ $=16000$ **AG**	B1 **[1]**	Convincing proof. Need to see sight of using $t = 0$. This may be implied by seeing 14500 + 1500. NB: 14500 + 1500 = 16000 is B1 BOD
6 (b)	$8000 = 14500e^{-0.37t}+1500$ $\ln\left(\frac{6500}{14500}\right)=\ln(e^{-0.37t})$ $t=\frac{-0.80234...}{-0.37}=2.168...$	M1 M1 M1 A1 **[4]**	States correct equation Re-arranges and takes logs to both sides. Uses ln(e) = 1 and re-arranges for their *t* Correct answer and no errors seen. ISW [SC: sight of $\ln(6500)=\ln(14500\,e^{-0.37t})$ is OK for the 2nd M1, but need to see use of product rule, ln(e) = 1 and then re-arrangement for *t* for 3rd M1.]
6 (c)	Limiting value for the price of the car is £1500	B1 **[1]**	Correct answer. Condone 1500 with no units

7 (a)	Re-arranges to $x^2+2x+y^2+3y=4$ Completes the square to give $(x+1)^2-1+\left(y+\frac{3}{2}\right)^2-\frac{9}{4}=4$ Obtains final answer of $(x+1)^2+\left(y+\frac{3}{2}\right)^2=\frac{29}{4}$	M1 A1 **[2]**	Attempts to complete the square on their x^2+kx term. Must be working from the equation of a circle. Obtains correct final answer. No need to state values of a, b or k but this is OK for final answer if the equation is not written down. Answer only is 3/3.
7 (b)	Centre of the circle is (–1, –1.5)	B1ft **[1]**	Correct coordinates of centre ft their (a)
7 (c)	$(0+1)^2+(1+1.5)^2=1+\frac{25}{4}=\frac{29}{4}$ as required	B1 **[1]**	For a correct and convincing proof that (0, 1) lies on the curve with a concluding statement. There are many approaches to this: e.g. they may also use (a) to show that LHS – RHS = 0. Concluding statements such as ‘as required’, ‘therefore P lies on C’, etc. are sufficient
7 (d)	Gradient of normal is $\frac{1--1.5}{0--1}=\frac{5}{2}$ So equation of normal is given by $y=\frac{5}{2}x+1$	M1 A1ft A1 oe **[3]**	Method to find the gradient of normal Correct gradient of normal stated and identified. Ft their (b) is allowed. Correct equation of the normal oe. ISW
7 (e)	Distance is the diameter of the circle so $\sqrt{29}$	B1ft **[1]**	Correct distance ft their (a). ISW
8 (a)	Discriminant is $(-3)^2-4(3)(4)=-39$ Since the discriminant is negative, the function $y=f(x)$ is always positive	B1* B1(dep*) **[2]**	Correct discriminant, correct completing the square, correct differentiation of f or correct application of another method Convincing explanation. If using completing the square, they must mention that their squared term is always positive in their explanation

8 (b)	If $n = 0$, then we have LHS = 1 + 1 = 2 and RHS = 1 + 1 = 2, so LHS = RHS and the statement is true in this case If $n = 1$, then LHS = 2 + 1 = 3 and RHS = 2 + 2 = 4 $\neq$ LHS, so the statement is not true in this case So the statement is sometimes true	B1* B1* B1(dep*) **[3]**	Provides a value of n for which the statement is true, and shows it is true in this case Provides a value of n for which the statement is false, and shows it is false in this case States that the statement is sometimes true. This is dependent on both previous B marks.
9 (a)	$2^{\frac{x+y}{2}} = 2^{-3(y+1)}$ $\Rightarrow \frac{x+y}{2} = -3(y+1)$ $\Rightarrow x+y = -6y-6$ $\Rightarrow x = -7y-6$	M1* M1(dep*) A1 **[3]**	Attempts to convert both sides to the same base. Allows two slips in index manipulation Equates powers and attempts to solve for x Correctly obtains x in terms of y. Final answer
9 (a) **ALT 1**	$\log\left(\left(\sqrt{2}\right)^{x+y}\right) = \log\left(\frac{1}{8^{y+1}}\right)$ $(x+y)\log\left(\sqrt{2}\right) = -(y+1)\log 8$ $x+y = -6y-6$ $\therefore x = -7y-6$	M1* M1(dep*) A1 **[3]**	Takes logs to both sides and gets to this stage Eliminates all log terms and attempts to solve for x Correctly obtains x in terms of y. Final answer

9 (b)	$\dfrac{(p+2\sqrt{3})(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}+\dfrac{p\sqrt{3}}{6}$ $\dfrac{p\sqrt{3}+2\sqrt{3}+p+6}{2}+\dfrac{p\sqrt{3}}{6}$ Comparing coefficients we have $\dfrac{p}{2}+1+\dfrac{p}{6}=5 \Rightarrow p=6$ Then $q=\dfrac{p+6}{2}=6$	B1 M1* A1 M1**(dep*) A1 M1(dep**) A1 **[7]**	Correctly rationalises the second term Method to rationalise the first term Correct unsimplified rationalised expression of first term Method to find the value of k by comparing coefficients Correct value of p Uses their p and their expression to find the value of q Correct value of q
10 (a)	Expansion is $3^8+\binom{8}{1}(3)^7\left(-\dfrac{x}{5}\right)+\binom{8}{2}(3)^6\left(-\dfrac{x}{5}\right)^2+\ldots$ First three terms are $6561-\dfrac{17496}{5}x+\dfrac{20412}{25}x^2$	B1 M1 A1 A1 **[4]**	For 3^8 oe One term of the form $k(3)^p(-x/5)^{8-p}$, $p \neq 0, 8$, $k \neq 0$ First three terms of expansion correct. No need for simplification here, but if using ${}^nC_r$, or equivalent, then these must be replaced by the correct coefficients Correct first three terms, fully simplified. Accept decimal equivalents for each coefficient. Final answer.
10 (b)	Expanding gives $6561b = 32805$ Obtains $b = 5$ Comparing also gives $6561a-\dfrac{17496}{5}b=-4374$ So $a = 2$	M1 A1 M1 A1 **[4]**	Obtains an equation in b by comparing constants ft their (a) Obtains correct value of b Forms correct equation in terms of a and b by comparing x terms ft their (a) Obtains correct value of a

11 (i) (a)	$\frac{dy}{dx} = 4x - 4 - \frac{5}{2}x^{\frac{3}{2}}$	B1 M1 A1 oe	Obtains terms 4x or –4 Correct method to differentiate the $x\sqrt{x}$ term Completely correct derivative oe. ISW
11 (i) (b)	$\frac{d^2y}{dx^2} = 4 - \frac{15}{4}\sqrt{x}$ so $\left(4 - \frac{15}{4}\sqrt{x}\right) - 4 = -\frac{15}{4}\sqrt{x}$ Hence $k = \frac{15}{4}$	M1* M1(dep*) A1 **[3]**	Attempts to differentiate their (a) a second term Method to find the value of k using their second derivative. Their second derivative must be of the form $4 + p\sqrt{x}$ Obtains correct value of k
11 (ii)	$\frac{dy}{dx} = 9x^2 - 4x$ $\left.\frac{dy}{dx}\right\|_{x=-1} = 9(-1)^2 - 4(-1) = 13$, so normal gradient is $-\frac{1}{13}$ At $x = -1$, $y = -5$ So equation of normal is $y - -5 = -\frac{1}{13}(x - -1)$ $\Rightarrow x + 13y + 66 = 0$	M1* A1 B1 M1(dep*) A1 **[5]**	Differentiates and substitutes $x = -1$ into their derivative Correct gradient of the normal identified or used to obtain final answer Correct y coordinate at $x = -1$ Method to find equation of the normal using their coordinates and a gradient they have identified as the gradient of the normal. Correct equation of the normal in the required form. Coefficients must be integers so accept integer multiples of this but not non-integer multiples. ISW

12 (a)	$\dfrac{\tan^2 x-1}{\tan^2 x+1}\equiv\dfrac{\dfrac{\sin^2 x}{\cos^2 x}-1}{\dfrac{\sin^2 x}{\cos^2 x}+1}$ $\equiv\dfrac{\sin^2 x-\cos^2 x}{\sin^2 x+\cos^2 x}$ $[\equiv\sin^2 x-\cos^2 x]$ $[\equiv 1-\cos^2 x-\cos^2 x]$ $\equiv 1-2\cos^2 x$ **AG**	M1 M1 A1 **[3]**	Replaces tan$x$ by sin$x$/cos$x$ Multiply top and bottom of fraction by $\cos^2 x$ and use $\sin^2 x+\cos^2 x=1$ in denominator Complete and convincing proof with no errors seen. One of the steps in square brackets, or equivalent, must be shown or a comment that they are using $\sin^2 x+\cos^2 x=1$ must be seen. If this is not the case, A0. For alternative methods, use and adapt the same scheme.
12 (b)	$3\sin^2\theta-(1-2\cos^2\theta)=1$ $3\sin^2\theta+2\cos^2\theta=2$ $3-3\cos^2\theta+2\cos^2\theta=2$ $\cos^2\theta=1$	M1 M1 A1 **[3]**	Uses their (a). Invisible brackets can score M1 (and even the A1 if recovered). Allow working in x here, but do not give the M1 for use of mixed variables unless recovered Obtains an equation only in cos using correct identity Complete and convincing proof with no errors seen (but condone invisible brackets that are recovered)
12 (c)	$3\theta=0,180,360$ Hence $\theta=0,\ 60,\ 120$	B1 B1 **[2]**	Two or three correct values of 3θ or **one** correct value of θ Correct values of θ and no others in range
13 (a)	$A(0,\ 0)$, $B(4,\ 0)$	B1 **[1]**	Correct coordinates identified. Condone coordinates just stated and not labelled A or B or even the wrong labels. Condone just $x=0$, $x=4$. ISW

13 (b)	$f(x)=\frac{1}{4}x^2(16-8x+x^2)$ $=4x^2-2x^3+\frac{1}{4}x^4$	M1 A1 **[2]**	Method to expand the brackets, obtaining an expression of degree 4 with three terms Correct expression, final answer.
13 (c) (i)	$f'(x)=8x-6x^2+x^3$ $f'(2)=8(2)-6(2)^2+2^3$ $=16-24+8$ $=0$ therefore, the point $x = 2$ is a stationary point on C	M1 A1 **[2]**	Computes derivative and substitutes 2 into their derivative (or any other method to show 2 is a factor of f \`(x) = 0 Convincingly shows the derivative at 2 is 0 and conclusion, 'i.e. qed, shown, as required, therefore, the point is a stationary point, etc.'
13 (c) (ii)	$f''(x)=8-12x+3x^2$ $f''(2)=8-12(2)+3(2)^2$ $=8-24+12$ $=-4<0$ since the second derivative is negative at $x = 2$, $x = 2$ is a maximum and so it is therefore the point P	B1 M1 A1 **[3]**	Obtains correct second derivative Substitutes 2 into their second derivative Shows second derivative is negative and gives some brief explanation why $x = 2$ corresponds to P/ is a maximum (< 0 is sufficient argument) NB: candidates need not compute the second derivative for the A1, they just need to give sufficient evidence that it is negative, i.e. '8 – 24 + 12 < 0' is OK for A1.
13 (d)	$\int_0^2 f(x)dx=\left[\frac{4}{3}x^3-\frac{1}{2}x^4+\frac{1}{20}x^5\right]_0^2$ $=\frac{4}{3}(2)^3-\frac{1}{2}(2)^4+\frac{1}{20}(2)^5-0=\frac{64}{15}$ Area of rectangle = $2\times4=8$ So area of R is $8-\frac{64}{15}=\frac{56}{15}$	M1* M1**(dep*) B1 M1(dep**) A1	Method to integrate f(x) with respect to x Substitutes correct limits into their integral in the correct way Correct area of rectangle Uses area of R = area of rectangle – their area under curve Correct exact area of R oe