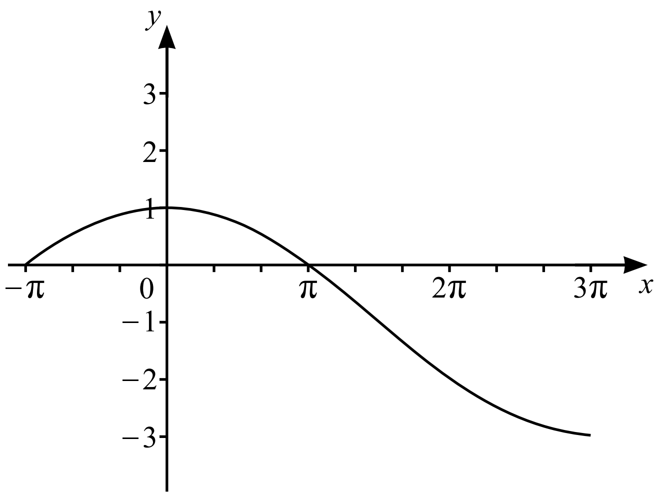
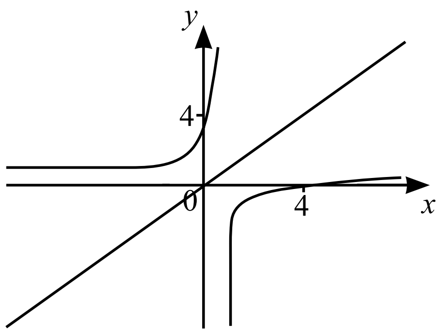
Question	Answer	Marks	Partial Marks
1	$f(x) = \pm 5(x + 1)(2x - 1)(x - 2)$	**3**	**B1** for ± **B1** for 5 **B1** for $(x + 1)(2x - 1)(x - 2)$ or equivalent factorisation
2(a)	p(2): $48 + 4a + 2b + 2 = 0$ $2a + b + 25 = 0$	**B1**	For $2a + b + 25 = 0$ or multiple
	$p(1) = -2p(0)$ $a + b + 12 = 0$	**B1**	For $a + b + 12 = 0$
	$a = -13$, $b = 1$	**2**	**M1** for attempt to solve *their* equations in a and b leading to 2 values **A1** for both
2(b)(i)	$p\left(\frac{1}{2}\right) = \frac{6}{8} - \frac{13}{4} + \frac{1}{2} + 2$	**M1**	For attempt to find $p\left(\frac{1}{2}\right)$ using *their* a and b
	0	**A1**	
2(b)(ii)	$(x - 2)(2x - 1)(3x + 1)$	**2**	**M1** for realising that 2 factors are known and 3rd factor can be obtained by observation or algebraic long division, or for making use of $x - 2$ or $2x - 1$ in order to obtain a quadratic factor **A1** Must see all factors together
3(a)	2	**B1**	
3(b)	6π or 1080°	**B1**	

Question	Answer	Marks	Partial Marks
3(c)		3	**B1** for a curve passing through $(-\pi, 0)$ and $(3\pi, -3)$ **B1** for correct shape with max on y-axis and a min at $x = 3\pi$ **B1** for passing through $(0, 1)$ and $(\pi, 0)$ only on the positive x-axis
4	$\overrightarrow{OB} = \mathbf{a} + \mathbf{c}$	**B1**	
	$\overrightarrow{DC} = \frac{2}{3}\mathbf{c}$ or $\overrightarrow{OD} = \frac{1}{3}\mathbf{c}$	**B1**	
	$\overrightarrow{CE} = \frac{1}{3}(\mathbf{a} - \mathbf{c})$ or $\overrightarrow{OE} = \frac{1}{3}(\mathbf{a} + 2\mathbf{c})$	**B1**	Allow unsimplified
	$\overrightarrow{DE} = \frac{1}{3}(\mathbf{a} + \mathbf{c})$	**B1**	
	$k = 3$	**B1**	
5(a)	$p = 16$	2	**B1** for $\log_a \frac{5p}{4} = \log_a 20$ oe **B1** for 16, nfww
5(b)	$(3(3^x) - 1)(3^x + 3) = 0$	**M1**	For recognition of a correct quadratic in 3^x and an attempt to factorise or use the quadratic formula
	$3^x = \frac{1}{3}$ $x = -1$	2	**M1 dep** for a correct attempt to solve $3^x = k$, $k > 0$ **A1** for one solution only, which must be from a correct solution

Question	Answer	Marks	Partial Marks
5(c)	**Either** $\log_y 2 = \frac{1}{\log_2 y}$ **or** $\log_2 y = \frac{1}{\log_y 2}$ **or** $\log_y 2 = \frac{\log_a 2}{\log_a y}$ and $\log_2 y = \frac{\log_a y}{\log_a 2}$	**B1**	May be implied
	Either $4(\log_y 2)^2 - 4(\log_y 2) + 1 = 0$ $(2\log_y 2 - 1)^2 = 0$, $\log_y 2 = \frac{1}{2}$ **or** $(\log_2 y)^2 - 4(\log_2 y) + 4 = 0$ $(\log_2 y - 2)^2 = 0$, $\log_2 y = 2$ **or** $(\log_a y)^2 - 4(\log_a 2)\log_a y + 4(\log_a 2)^2 = 0$ $(\log_a y - 2\log_a 2)^2 = 0$ $\log_a y = 2\log_a 2$	**M1**	For obtaining a 3-term quadratic equation in either $\log_y 2$ or $\log_2 y$ and solving to obtain $\log_y 2 = k$ or $\log_2 y = k$, may be implied or equivalent using an alternative base
	$y = 4$	**A1**	
6(a)(i)	$\mathrm{f}(x) > 1$	**B1**	
	$\mathrm{g}(x) \in \mathbb{R}$	**B1**	
6(a)(ii)	$\mathrm{g}(0) = 1$, $\mathrm{g}(1) = 2$	**M1**	For attempt at $\mathrm{g}^2(0)$ or $\mathrm{g}^2(x)$
6(a)(iii)	Attempt at $\mathrm{f}(2)$ or $\mathrm{fg}^2(x)$	**M1**	Must have the correct order of operations
	$\mathrm{fg}^2(0)$ or $\mathrm{f}(2) = 3\mathrm{e}^4 + 1$	**A1**	

Question	Answer	Marks	Partial Marks
6(a)(iv)		**B1**	For correct f and (0, 4) , must be in first and second quadrant
		B1	For correct f^{-1} and (4, 0), must be in first and fourth quadrant
		B1	For $y = x$ and/or symmetry implied, by 'matching intercepts'. No intersection.
		B1	For both asymptotes $x = 1$ and $y = 1$
6(b)(i)	Undefined at $x = 0$ oe	**B1**	
6(b)(ii)	$4 = a + b$	**M1**	For attempt at h(1) and differentiation to obtain h′(1), must have the form $h'(x) = \frac{p}{x^3}$ oe
	$b = -8$ $a = 12$	**A1**	For both
7(a)	$a + 4d = \frac{1}{3}(a + 15d)$	**B1**	
	$a + 4d + a + 15d = 33$	**B1**	
	$a = \frac{9}{4}, d = \frac{3}{2}$	**2**	**M1** for attempt to solve *their* equations simultaneously **A1** for both
	$S_{10} = \frac{10}{2}\left(2\left(\frac{9}{4}\right) + 9\left(\frac{3}{2}\right)\right)$	**M1**	For correct use of the sum formula for 10 terms using *their a* and *d*
	90	**A1**	

Question	Answer	Marks	Partial Marks
7(b)	$a + ar = 16$	**B1**	
	$\frac{a}{1-r} = 25$	**B1**	
	$\frac{16}{25} = (1-r)(1+r)$	**M1**	For attempt to obtain and solve an equation in *r* only
	$r = \pm\frac{3}{5}$	**A1**	For both ±
	$a = 10$	**A1**	
	$a = 40$	**A1**	
	Alternative $a + ar = 16$	**(B1)**	
	$\frac{a}{1-r} = 25$	**(B1)**	
	$a^2 - 50a + 400 = 0$	**(2)**	**M1** for attempt to obtain a 3-term quadratic equation in a using *their* equations
	$a = 10$ and $a = 40$	**(2)**	**M1** for attempt to solve *their* quadratic
8(a)	$\left[\ln(2x+3) + \ln(3x-1) - \ln x\right]_1^a$	**2**	**B1** for 1 term correct **B1** all correct
	$(\ln(2a+3) + \ln(3a-1) - \ln a) - (\ln 5 + \ln 2)$	**M1**	Correct substitution of limits, dep on first **B1**, ignore equality Must have 3 terms involving *x*
	$\ln\frac{(2a+3)(3a-1)}{10a} = \ln 2.4$	**M1**	For use of both addition and subtraction rules, ignore equality, or for use of addition rule on each side of an equation
	$6a^2 - 17a - 3 = 0$	**A1**	
	$a = 3$	**2**	**M1** for solution of *their* quadratic **A1** for $a = 3$ only
8(b)(i)	$18k\sin^2 kx\cos kx$	**2**	**M1** for $p\sin^2 kx\cos kx$, where *p* is a multiple of *k*
8(b)(ii)	$\frac{1}{6}\sin^3 2x + c$	**2**	**B1** for $\frac{1}{6}\sin^3 2x$

Question	Answer	Marks	Partial Marks
9(a)	$v = \frac{1}{2}(3t+2)^{\frac{2}{3}}\ (+c)$	**M1**	For $k(3t+2)^{\frac{2}{3}}$
	$v = \frac{1}{2}(3t+2)^{\frac{2}{3}} + 6$	**2**	**M1 dep** for use of $s = 4.8$ and $t = 2$ in *their* expression for v to find c
9(b)	$t \geqslant 0$ so $v > 0$ oe	**B1**	
9(c)	$s = \frac{1}{10}(3t+2)^{\frac{5}{3}} + 6t\ (+d)$	**M1**	For $p(3t+2)^{\frac{5}{3}}$
	$s = \frac{1}{10}(3t+2)^{\frac{5}{3}} + 6t - 20$	**2**	**M1 dep** for use of $v = 8$ and $t = 2$ in *their* expression for s to find d
	When $t = \frac{25}{3}$, $s = 54.3$	**A1**	
10	$(x-2)^2 + (y+4)^2 = 9$ oe	**B1**	For equation of the circle
	$(x-2)^2 + (2x+1)^2 = 9$ oe or $\left(\frac{y-1}{2}\right)^2 + (y+4)^2 = 9$	**M1**	For obtaining an equation in one variable using *their* equation for the circle and $y = 2x - 3$ and attempt to solve to obtain either $x = \ldots$ or $y = \ldots$
	$x = \frac{2}{\sqrt{5}},\ y = \frac{4}{\sqrt{5}} - 3$ $x = -\frac{2}{\sqrt{5}},\ y = -\frac{4}{\sqrt{5}} - 3$	**2**	**A1** for one correct set of coordinates **A1** for a second correct set of coordinates
	$(AB)^2 = \left(\frac{4}{\sqrt{5}}\right)^2 + \left(\frac{8}{\sqrt{5}}\right)^2$	**M1**	For use of Pythagoras' theorem to obtain the length AB, using *their* coordinates for A and B
	$AB = 4$	**A1**	
	$XY = 6$	**B1**	
	Area of kite = 12	**A1**	**FT** on *their* $\frac{1}{2} \times AB \times 6$