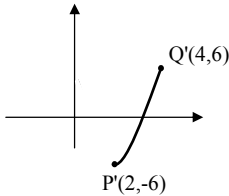
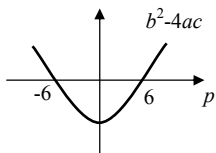


	Give 1 mark for each •	Illustration(s) for awarding each mark
1.	<p>(a) ans: $k = 2$ 1 mark</p> <ul style="list-style-type: none"> •1 sub. to answer <p>(b) ans: $y = 3x - 7$ (or equiv.) 3 marks</p> <ul style="list-style-type: none"> •1 for gradient of line •2 for gradient of AB •3 for equation <p>(c) ans: $A(0,-7)$ 1 mark</p> <ul style="list-style-type: none"> •1 answer (y intercept) 	<p>(a) •1 $3 + 3k = 9 \therefore k = 2$</p> <p>(b) •1 $m = -\frac{1}{3}$ •2 $m_{AB} = 3$ •3 $y - 2 = 3(x - 3)$</p> <p>(c) •1 $A(0,-7)$</p>
2.	<p>(a) ans: $a = 2$ 3 marks</p> <ul style="list-style-type: none"> •1 knowing to solve deriv. to zero •2 carrying out synthetic division •3 solving equation to zero and answer <p>(b) ans: zero, another stat. point 3 marks</p> <ul style="list-style-type: none"> •1 substituting for a •2 substituting for a and -2 •3 calculation finds zero + conclusion <p>** pupils may complete part (a) by substitution.</p>	<p>(a) •1 at s.p. $f'(x) = 0$ (stated or implied)</p> <p>•2 $4 \begin{array}{r rrrr} 1 & -a & -4a & 0 \\ & 4 & 16-4a & 64-32a \\ \hline & 1 & 4-a & 16-8a & 0 \end{array}$</p> <p>•3 $64 - 32a = 0$, $a = 2$</p> <p>(b) •1 $f'(x) = x^3 - 2x^2 - 8x$ •2 $f'(-2) = (-2)^3 - 2(-2)^2 - 8(-2)$ •3 $f'(-2) = 0 \therefore$ another stat. point</p>
3.	<p>(a) ans: see sketch 3 marks</p> <ul style="list-style-type: none"> •1 for reflecting •2 for translation up 6 •3 for annotating, coordinates <p>(b) ans: $g(x) = 3x^2 - 12x + 6$ 1 marks</p> <ul style="list-style-type: none"> •1 for answer (any equivalent form) 	<p>(a) •1 </p> <p>•2 •3</p> <p>(b) •1 $g(x) = -(12x - 3x^2) + 6$</p>
4.	<p>ans: $a = -6$ 4 marks</p> <ul style="list-style-type: none"> •1 integrating •2 substitute in limits •3 simplifying to quad. equation •4 solving and choosing answer 	<ul style="list-style-type: none"> •1 $4x + x^2$ •2 $(8 + 4) - (4a + a^2) = 0$ •3 $a^2 + 4a - 12 = 0$ •4 $(a - 2)(a + 6) = 0$ $a = 2$ or $a = -6$

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5.	<p>(a) ans: $\sqrt{2} \cos(3x - \frac{\pi}{4})$ 4 marks</p> <ul style="list-style-type: none"> •1 recognising as $k \cos(\dots)$ equation •2 finding k •3 finding α •4 write down expression <p>(b) ans: $x = 0, \frac{\pi}{6}$ 4 marks</p> <ul style="list-style-type: none"> •1 solving to 1 •2 selecting correct angle for $3x - \frac{\pi}{4} =$ •3 answer 	<p>(a)</p> <ul style="list-style-type: none"> •1 $\sin 3x + \cos 3x = k \cos(3x - \alpha)$ (or equivalent) •2 $k^2 = 1^2 + 1^2 \therefore k = \sqrt{2}$ •3 $\tan \alpha = \frac{1}{1}, \alpha = \frac{\pi}{4}$ •4 $\sqrt{2} \cos(3x - \frac{\pi}{4})$ <p>(b)</p> <ul style="list-style-type: none"> •1 $\sqrt{2} \cos(3x - \frac{\pi}{4}) = 1$ •2 $\cos(3x - \frac{\pi}{4}) = \frac{1}{\sqrt{2}} \therefore 3x - \frac{\pi}{4} = \frac{\pi}{4}, -\frac{\pi}{4}$ •3 $3x = \frac{\pi}{2} \therefore x = \frac{\pi}{6}$ •4 $3x = 0 \therefore x = 0$
6.	<p>ans: $h(x) = (x + 4)^2 + 4$, $h_{\min} = 4$ @ $x = -4$ 6 marks</p> <ul style="list-style-type: none"> •1 for f into g •2 for expansion and simplifying •3 bracket term •4 number term •5 for minimum value •6 for x 	<ul style="list-style-type: none"> •1 $g(f(x)) = (x + 1)^2 + 6(x + 1) + 13$ •2 $h(x) = x^2 + 8x + 20$ •3 $[(x + 4)^2 \dots \dots]$ •4 $\dots \dots - 16] + 20$ •5 $\min = 4$ •6 @ $x = -4$
7.	<p>(a) ans: proof 5 marks</p> <ul style="list-style-type: none"> •1 know to solve a system •2 combining equations •3 simplifying to quad. •4 for 1st coordinate •5 for 2nd coordinate <p>(b) ans: B(9,-3), $(x - 9)^2 + (y + 3)^2 = 45$ 6 marks</p> <ul style="list-style-type: none"> •1 knowing T mid-pt between centres •2 drawing out centre of top circle •3 finding B •4 knowing r the same •5 finding r^2 •6 writing down equation of lower circle 	<p>(a)</p> <ul style="list-style-type: none"> •1 set up a system •2 $(2y)^2 + y^2 - 6(2y) - 18y + 45 = 0$ •3 $5y^2 - 30y + 45 = 0$ •4 $5(y - 3)(y - 3) = 0 \therefore y = 3$ •5 $x = 2(3) = 6$ (or equivalent) <p>(b)</p> <ul style="list-style-type: none"> •1 strategy •2 A(3,9) •3 A(3,9) \rightarrow T(6,3) \rightarrow B(9,-3) •4 stated or implied $r_1 = r_2$ •5 $r^2 = \sqrt{9 + 81} - 45 = 45$ •6 $(x - 9)^2 + (y + 3)^2 = 45$

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8.	<p>ans: $y = 3x^2 - 6x + 4$ 4 marks</p> <ul style="list-style-type: none"> •1 prepare to integrate •2 integrate •3 substitute. •4 arrange equation 	<ul style="list-style-type: none"> •1 $\int (6x - 6)dx$ •2 $3x^2 - 6x + c$ •3 $1 = 3 - 6 + c \Rightarrow c = 4$ •4 answer
9.	<p>ans: $f'(x) = 1 + \frac{1}{x^{\frac{3}{2}}}, \frac{9}{8}$ 6 marks</p> <ul style="list-style-type: none"> •1 preparing to differentiate •2 diff. 1st term •3 diff. 2nd term •4 writing with positive indices •5 substituting •6 answer 	<ul style="list-style-type: none"> •1 $f(x) = x^{-1}(x^2 - 2x^{\frac{1}{2}})$ $= x - 2x^{-\frac{1}{2}}$ •2 1..... •3 $+ x^{-\frac{3}{2}}$ •4 $f'(x) = 1 + \frac{1}{x^{\frac{3}{2}}}$ •5 $f'(4) = 1 + \frac{1}{\sqrt{4^3}}$ •6 $f'(4) = 1 + \frac{1}{8} = \frac{9}{8}$
10.	<p>ans: $-6 < p < 6$ (or equivalent) 6 marks</p> <ul style="list-style-type: none"> •1 dealing with the fractions •2 manipulation to quad. form •3 discriminant statement •4 for a, b and c •5 finding discriminant •6 solution from quadratic inequation 	<ul style="list-style-type: none"> •1 strategy $\times x$ (or equiv.) •2 $x^2 + 9 = px$ $x^2 - px + 9 = 0$ •3 for no real roots $b^2 - 4ac < 0$ •4 $a = 1, b = -p, c = 9$ •5 $p^2 - 36 < 0$ •6 $-6 < p < 6$ 

Total 60 marks