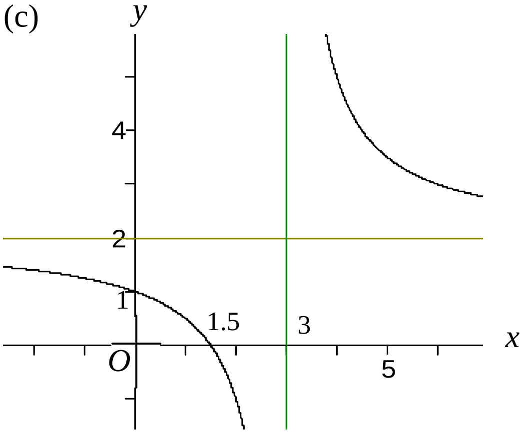
7	(a) $A\,(1\frac{1}{2}\,,\,0)$, $B\,(0\,,\,1\,)$	B1, B1	
	(b) (i) $x = 3$	B1	
	(ii) $y = 2$	B1	
	(c) 	B1 B1 B1	two branches in correct quadrants asymptotes dep on some curve intercepts
	(d) $\frac{dy}{dx} = \frac{2(x-3)-(2x-3)}{(x-3)^2} = \frac{-3}{(x-3)^2}$	M1 A1	Quotient rule Result (unsimplified)
	At B, $x = 0$ so $\frac{dy}{dx} = \frac{-3}{(-3)^2} = -\frac{1}{3}$	A1	
	Grad of normal = -1/(-1/3) = 3	B1ft	
	Normal $y = 3x + 1$	B1ft	
	(e) At D, $3x+1=\frac{2x-3}{x-3}$	M1	
	$3x^2 - 8x - 3 = 2x - 3$		
	$3x^2 - 10x = 0$	A1	
	$x(3x - 10) = 0$	M1	
	$x = 0$ or $x = 10/3$		
	At D, $x = 3\frac{1}{3}$	A1	
		16	

8	(a) $k = \alpha/\beta \times \beta/\alpha = 1$	B1
	(b) $\alpha\beta = 15$ and $\alpha + \beta = -m$	M1 A1
	$-h = \alpha/\beta + \beta/\alpha$	M1
	$= \dfrac{\alpha^2 + \beta^2}{\alpha\beta}$	M1
	$= \dfrac{(\alpha+\beta)^2 - 2\alpha\beta}{\beta\alpha}$	M1
	$\Rightarrow \; h = \dfrac{30 - m^2}{15}$	A1 oe
	(c) $\alpha\beta = 15 \Rightarrow \alpha(2\alpha + 1) = 15$	M1
	$2\alpha^2 + \alpha - 15 = 0$	
	$(2\alpha - 5)(\alpha + 3) = 0$	M1
	$\alpha = 2\frac{1}{2}$ or $\alpha = -3$	A1
	(d) $\beta = 2 \times 2\frac{1}{2} + 1 = 6$ or $\beta = 2 \times -3 + 1 = -5$	M1
	$m = -(\alpha + \beta) = -(2\frac{1}{2} + 6)$ or $-(-3 - 5)$	M1
	$m = -8\frac{1}{2}$ or 8	A1
		13
9	(a) $BD^2 = 5^2 + 6^2 = 61$, $BC^2 = 8^2 + 6^2 = 100$, $CD^2 = 8^2 + 5^2 = 89$	M1 A2, 1, 0
	$100 = 61 + 89 - 2\sqrt{61}\sqrt{89}\cos BDC$	M1
	$\cos BDC = 25/\sqrt{(61 \times 89)}$	A1
	$= 0.3393$	
	$\angle BDC = 70.2^\circ$	A1
	(b) Area $BDC = \frac{1}{2}\sqrt{61}\sqrt{89}\sin 70.2^\circ$	M1 A1ft
	$= 34.7\text{ cm}^2$ (3sf)	A1 allow 34.6
	(c) Area $DAC = \frac{1}{2} \times 5 \times 8 = 20$	B1
	(d) $20 = \frac{1}{2} \times \sqrt{89} \times AE \Rightarrow AE = 40/\sqrt{89}$	M1 A1
	(e) Angle is $\angle BEA$	M1 identify angle
	$\tan BEA = 6/AE = 6\sqrt{89}/40$	M1 A1ft
	$= 1.415$	
	$\Rightarrow \angle BEA = 54.8^\circ$	A1
		16

10	(a)	(i) $\overrightarrow{BC}$ = - ½ **c** –**a** + **c** = ½ **c** – **a**	M1 A1
		(ii) $\overrightarrow{PQ}$ = ¾ **a** + ½ **c** + ⅓(½ **c** – **a**) = $^5/_{12}$ **a** + ⅔ **c**.	M1 ¾ **a** + ½ **c** + … M1 ⅓(½ **c** – **a**) A1
	(b)	(i) $\overrightarrow{AT}$ = -¾ **a** + λ ($^5/_{12}$ **a** + ⅔ **c)**	B1ft
		(ii) $\overrightarrow{AT}$ = μ (**c** – **a**)	B1
	(c)	-¾ **a** + λ ($^5/_{12}$ **a** + ⅔ **c) =** μ (**c** – **a**) $\Rightarrow$-¾ + $^5/_{12}\,\lambda$ = - μ and ⅔ λ = μ $\Rightarrow$ $^5/_{12}\,\lambda$ = ¾ - ⅔ λ $\Rightarrow$ 5 λ = 9 – 8 λ $\Rightarrow$ λ = $^9/_{13}$ $\Rightarrow$ $PT:TQ$ = 9 : 4	M1 M1 A1ft M1 A1 A1ft **13**
11	(a)	$V = \pi\int_0^h x^2 dy = \pi\int_0^h \left(10y - y^2\right)dy$ $= \pi\left[5y^2 - \frac{1}{3}y^3\right]_0^h$ $= \pi\left[5h^2 - \frac{1}{3}h^3\right]$ = 1/3 $\pi h^2(15 - h)$	M1 use of $\int \pi x^2\, dy$ M1 A1 integration M1 use of correct limits A1 cso
	(b)	$V = \pi(5h^2 - ⅓h^3) \Rightarrow \frac{dV}{dh} = \pi(10h - h^2)$	B1 oe
	(c)	$\frac{dV}{dt} = \pi(10h - h^2)\frac{dh}{dt}$ When h=1.5, 6 = $\pi(15 - 2.25)\ ^{dh}/_{dt}$ $\Rightarrow\ ^{dh}/_{dt} = 6/(12.75\pi)$ = 0.150 cm/s (3sf)	M1 chain rule M1 A1 substitution A1 cao
	(d)	$W = \pi x^2 = \pi(10y - y^2)$ When depth is h, $W = \pi(10h - h^2)$ $\frac{dV}{dt} = \pi(10h - h^2)\frac{dh}{dt} = W\frac{dh}{dt}$ Since $^{dV}/_{dt}$ = 6, $^{dh}/_{dt} = 6/W$ so k = 6	B1 M1 A1 **13**