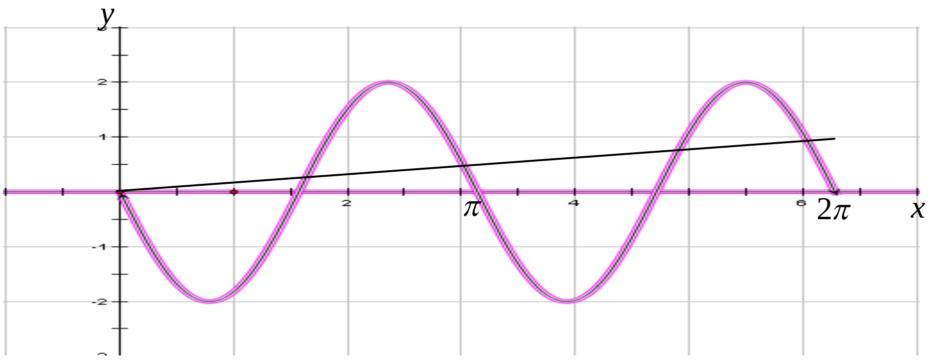
EXCEL 2 / PAPER 2 / YEAR 2009

No.	Solution and Mark Scheme	Sub Marks	Total Marks
1	$x = 3y - 1 \quad OR \quad y = \frac{x+1}{3}$ **P1** *substitute correctly* $2*(3y-1) - 2y = 2*(3y-1)^2 - 11y^2$ $Or \quad 2x - 2*\left(\frac{x+1}{3}\right) = 2x^2 - 11*\left(\frac{x+1}{3}\right)^2$ **K1** $7y^2 - 16y + 4 = 0 \quad OR \quad 7x^2 - 34x - 5 = 0$ **K1** $(7y-2)(y-2) = 0 \;\; OR \;\; (7x+1)(x-5) = 0$ $y = \frac{2}{7},\ 2$ **N1** $x = -\frac{1}{7},\ 5$ **N1** $\therefore x = -\frac{1}{7}\ ,\ y = \frac{2}{7}\ ;\ x = 5\ ,\ y = 2$	5	**5**
2 (a) (b)	A(0, –8) **N1** <u>*By using completing the square method*</u> $f(x) = -\left(x - \frac{k}{2}\right)^2 + \frac{k^2}{4} - 8$ **K1** $\frac{k}{2} = 2$ or $\frac{k^2}{4} - 8 = h$ **K1** $k = 4$ **N1** $h = \frac{4^2}{4} - 8 = -4$ **N1**	1	

          (c)	*<u>By using differentiation method</u>* $-2x+k=0$ **K1** $-2(2)+k=0$ $k=4$ **N1** $h=f(2)$ **K1** $=-(2)^2+4(2)-8$ **N1** $=-4$ $-x^2+4x-8\le -5$ **K1** $x^2-4x+3\ge 0$ **K1** $(x-3)(x-1)\ge 0$ $x\le 1\ ,\ \ x\ge 3$ **N1**	4 3	 **8**
3 (a) (b)	$a=3,\quad a+d=6,\qquad \therefore d=3$ **K1** $\frac{n}{2}[2(3)+(n-1)3]=630$ **K1** $n^2+n-420=0$ $(n-20)(n+21)=0$ **K1** $n=20$ **N1** $T_{20}=3+(20-1)3$ **K1** $=60$ **N1**	4 2	 **6**
4 (a)	 Shape of sin x **P1** Maximum = 2, minimum = –2 **P1** 2 periods for $0\le x\le 2\pi$ **P1** Inverted sin x **P1**	4	

(b)	$y = \frac{x}{2\pi}$ or equivalent **N1** Draw the straight line $y = \frac{x}{2\pi}$ **L1** No. of solutions = 5 **N1**	3	**7**
5(a) (b)	L = 50.5 or F_m = 15 or f_m = 14 **P1** $Median = 50.5 + \left[\frac{\frac{40}{2} - 15}{14}\right]10$ **K1** Median = 54.07 **N1** $\bar{x} = \frac{35.5(6)+45.5(9)+55.5(14)+65.5(7)+75.5(4)}{40}$ **K1** $= 54$ **N1** $\sigma = \sqrt{\frac{35.5^2(6)+45.5^2(9)+55.5^2(14)+65.5^2(7)+75.5^2(4)}{40} - 54^2}$ **K1** $= 11.74$ **N1**	3 4	 **7**
6 (a) (b)	$A(0, -4)$ **N1** $y = 2x - 4$ **K1** $2y + x - 12 = 0$ $2(2x-4) + x - 12 = 0$ **K1** $D(4, 4)$ **N1**	1 3	

(c)	$AD : DC = m : n$ $A(0,-4)$ $\dfrac{(5)m+(0)n}{m+n} = 4*$ **K1** $m = 4n$ **K1** $\dfrac{m}{n} = \dfrac{4}{1}$ $AD : DC = 4:1$ **N1**	3	**7**
7 (a)	| $\sqrt{x}$ | 1 | 2 | 3 | 4 | 5 | 6 | **N1** | $\log_{10} y$ | 0.2553 | 0.4314 | 0.6075 | 0.7839 | 0.9595 | 1.136 | **N1** Using the correct, uniform scale and axes **P1** All points plotted correctly **P1** Line of best fit **P1**	5	
(b)	$\log_{10} y = (\log_{10} k)\sqrt{x} + \log_{10} p$ (or implied) **P1** use $*m = \log_{10} k$ **K1** $k = 1.501$ **N1** use $*c = \log_{10} p$ **K1** $p = 1.202$ **N1**	5	**10**

8 (a) (i)	$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$ $= -3\underset{\sim}{i} - 4\underset{\sim}{j} + 6\underset{\sim}{i} + \underset{\sim}{j}$ $= 3\underset{\sim}{i} - 3\underset{\sim}{j}$ **N1**		
(ii)	$\overrightarrow{AP} = \frac{1}{2}\overrightarrow{AB}$ $= 3\underset{\sim}{i} + \frac{1}{2}\underset{\sim}{j}$ $\overrightarrow{OP} = \overrightarrow{OA} + \overrightarrow{AP}$ $= 3\underset{\sim}{i} + 4\underset{\sim}{j} + 3\underset{\sim}{i} + \frac{1}{2}\underset{\sim}{j}$ **K1** $= 6\underset{\sim}{i} + \frac{9}{2}\underset{\sim}{j}$ **N1**	3	
(b)	$\overrightarrow{OB} = \overrightarrow{OC} + \overrightarrow{CB} = 6\underset{\sim}{i} + \underset{\sim}{j} + 3\underset{\sim}{i} + 4\underset{\sim}{j}$ $= 9\underset{\sim}{i} + 5\underset{\sim}{j}$ **K1** $\lvert\overrightarrow{OB}\rvert = \sqrt{9^2 + 5^2}$ $= \sqrt{106}$ **K1** $\frac{9\underset{\sim}{i}}{\sqrt{106}} + \frac{5\underset{\sim}{j}}{\sqrt{106}}$ **N1**	3	
(c)	$\overrightarrow{OQ} = \overrightarrow{OA} + h\overrightarrow{AC}$ $= (3+3h)\underset{\sim}{i} + (4-3h)\underset{\sim}{j}$ *OR* $\overrightarrow{OQ} = k\overrightarrow{OP}$ $= 6k\underset{\sim}{i} + \frac{9}{2}k\underset{\sim}{j}$ **K1** Solve the simultaneous equations: $6k = 3 + 3h$ and $\frac{9}{2}k = 4 - 3h$ $\frac{9}{2}k = 4 - 3(2k-1)$ **K1** $k = \frac{2}{3}$ **N1** $h = \frac{1}{3}$ **N1**	4	**10**

9(a) (i)	$p = 0.42$ **N1**	1	
(ii)	$P(X \geq 2)$ **K1** $= 1 - [P(X = 0) + P(X = 1)]$ $= 1 - [{}^{10}C_0(0.42)^0(0.58)^{10} + {}^{10}C_1(0.42)^1(0.58)^9]$ **K1** $= 1 - [0.004308 + 0.031196]$ $= 0.9645$ **N1**	3	
(b)	$P(X \geq 50)$ $= P(Z \geq 1.4)$ **K1** $= 0.0808$ Number of candidates who passed the examination $= 0.0808 \times 3400$ **K1** $= 274$ **N1**	3	
	$P(X \leq x) = 0.2$ $P(Z \leq \frac{x-43}{5}) = 0.2$ **K1** $\frac{x-43}{5} = -0.842$ **K1** $x = 38.79 \ // \ 39 \ \left(\textit{accept from } 38 - 39 \textit{ inclusive}\right)$ **N1**	3	**10**
10 (a) (i)	$y(5-y) = y$ **K1** $y = 4$ $A(4,4)$ **N1**		
(ii)	Area of $P = \int_0^4 (5y - y^2)dy - \frac{1}{2}(4 \times 4)$ **K1** $= \left[\frac{5}{2}y^2 - \frac{y^3}{3}\right]_0^4 - 8$ **K1** $= \frac{32}{3}$ **N1**	5	

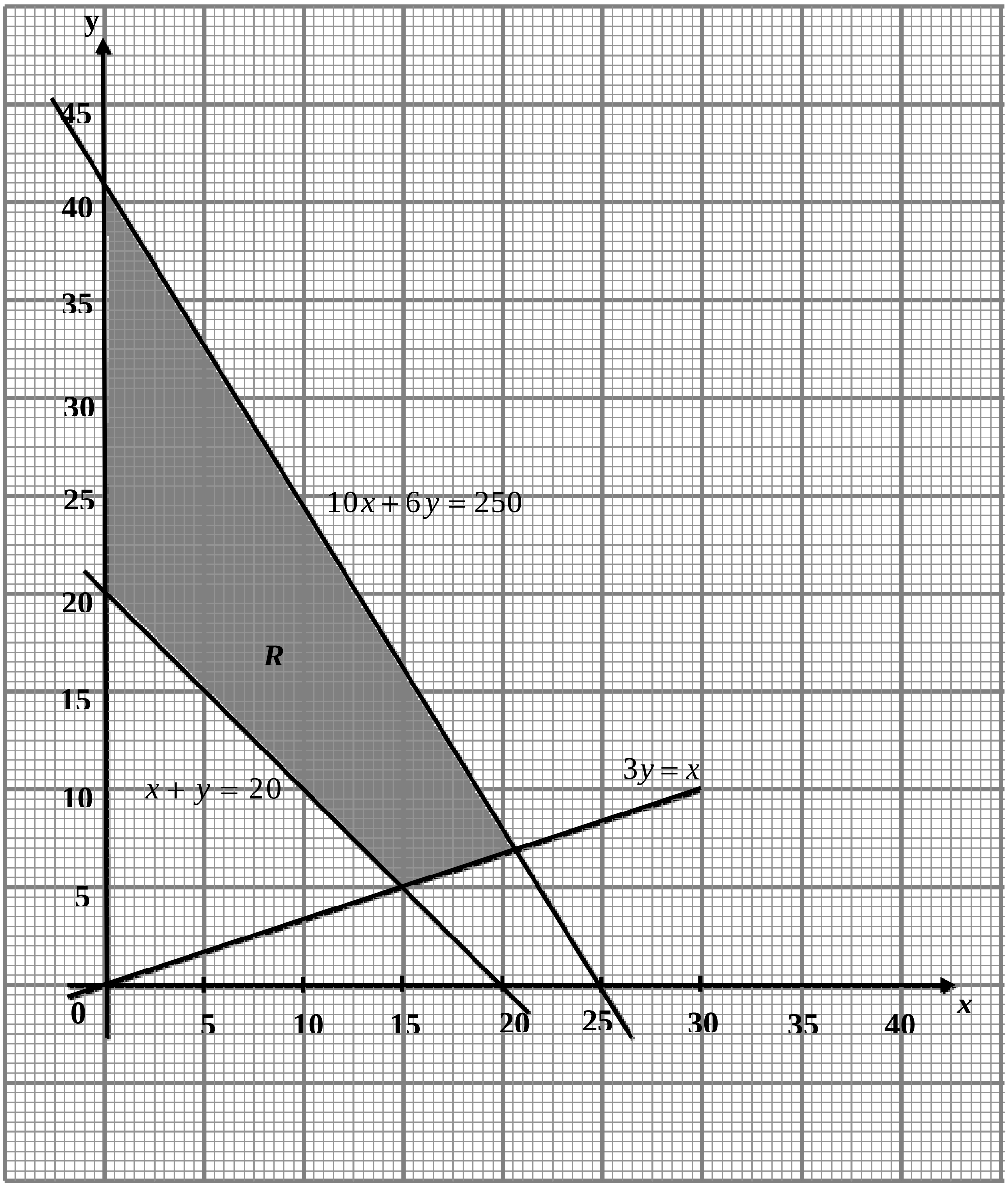
(b) (i)	$V=\frac{1}{3}(9^2)(10)=270\text{ cm}^3$ or $\delta V=-9.5\times 20=-190\text{ cm}^3\text{s}^{-1}$ **P1** $\frac{1}{3}(\frac{9}{10}h)^2h=80$ **K1** $h=\frac{20}{3}\text{ cm}$ **N1**	3	
(ii)	$\frac{dV}{dt}=\frac{dV}{dh}\times\frac{dh}{dt}$ $\frac{dV}{dt}=\frac{81}{100}h^2\times\frac{dh}{dt}$ $-20=\frac{81}{100}(\frac{20}{3})^2\times\frac{dh}{dt}$ **K1** $\frac{dh}{dt}=-\frac{5}{9}\text{ cm s}^{-1}$ **N1**	2	**10**
11 (a)	$\theta=120°$ **P1**	1	
(b)	$\cos 60°=\frac{5}{OS}$ **K1** $OS=10\text{ cm}$ **N1**	2	
(c)	$SQ=\sqrt{10^2-5^2}$ $=8.660\text{ cm}$ **N1** Area of the diagram **K1** **K1** $=2(\frac{1}{2})(5)(8.66)+\frac{1}{2}(\frac{240}{180})(3.142)(5^2)$ $=43.30+52.37$ $=95.67\text{ cm}^2$ **N1**	4	
(d)	Chord $QR=2(5\sin 60°)$ $=8.660\text{ cm}$ **N1** Perimeter of the shaded region = 2(3.142)(5) + 3(8.660) **K1** = 57.4 cm **N1**	3	**10**

12 (a)	When $t = 0$, Initial velocity, $v = 18 + 12(0) - 6(0)^2$ $= 18 \text{ ms}^{-1}$ **N1**	1	
(b)	$a = 12 - 12t$ For maximum velocity, $a = 0$ $12 - 12t = 0$ **K1** $t = 1$ $v = 18 + 12(1) - 6(1)^2$ **K1** $= 24 \text{ ms}^{-1}$ **N1**	3	
(c)	$18 + 12t - 6t^2 > 0$ **K1** $3 + 2t - t^2 > 0$ $(3 - t)(1 + t) > 0$ **K1** $0 \le t < 3$ **N1**	3	
(d)	$d = \int_0^3 18 + 12t - 6t^2 \; dt$ **K1** $= [18t + 6t^2 - 2t^3]_0^3$ $= [18(3) + 6(3)^2 - 2(3)^3] - 0$ **K1** $= 54 \text{ m}$ **N1**	3	**10**
13 (a)	$\frac{135}{120} = \frac{45}{Q_{95}}$ **K1** $Q_{95} = \frac{45 \times 120}{135}$ **K1** $= \text{RM}40$ **N1**	3	
(b) (i)	$\bar{I}_{2005/2000} = \frac{120 \times 5 + 130 \times 4 + 105 \times 3 + 115 \times 3}{15}$ **K1** $= \frac{1780}{15}$ $= 118.67$ **N1**		

(ii) (iii)	Price index for 2008 : 114 , 130 , 126 , 115 **N1** $\bar{I}_{2008/2000} = \dfrac{114\times5+130\times4+126\times3+115\times3}{15}$ **K1** $= \dfrac{1813}{15}$ $= 120.87$ **N1** $120.87 = \dfrac{Q_{2008}}{1080}\times100$ $Q_{2008} = \dfrac{120.87\times1080}{100}$ **K1** $=$ RM 1305.40 **N1**	7	**10**
14 (a) (i) (ii) (b)	$\dfrac{\sin\angle PRQ}{10} = \dfrac{\sin 28^\circ}{5}$ **K1** $\angle PRQ = 69.87^\circ$ *OR* Obtuse angle $PRQ = 180^\circ - 69.87^\circ$ $= 110.13^\circ$ **N1** $\angle PQR_2 = 180^\circ - 28^\circ - 69.87^\circ$ $= 82.13^\circ$ **P1** Area of the new $\Delta PQR_2 = \dfrac{1}{2}\times10\times5\times\sin 82.13^\circ$ **K1** $= 24.76\text{ cm}^2$ **N1** $AD = \sqrt{8^2+7^2} = \sqrt{113}$ *OR* $DC = \sqrt{7^2+10^2} = \sqrt{149}$ *OR* $AC = \sqrt{8^2+10^2} = \sqrt{164}$ **P1** $\left(\sqrt{164}\right)^2 = \left(\sqrt{113}\right)^2 + \left(\sqrt{149}\right)^2 - 2\left(\sqrt{113}\right)\left(\sqrt{149}\right)\cos\angle ADC$ **K1** $\angle ADC = 67.81^\circ$ **N1** Area of $\Delta ADC = \dfrac{1}{2}\times\sqrt{113}\times\sqrt{149}\times\sin 67.81^\circ$ **K1** $= 60.07\text{ cm}^2$ **N1**	5 5	 **10**

15 (a)	$x + y \geq 20$, **N1** $x \leq 3y$, **N1** $10x + 6y \leq 250$ **N1**	3	
(b)	Draw correctly at least one straight line from the *inequalities which Involves *x* and *y*. **K1** Draw correctly all the three *straight lines. **N2** Note : Accept dotted lines. The correct region shaded. **N1**	4	
(c)	$x = 5, \quad y = 15$ **K1** $\text{RM } 250 - (15 \times \text{RM}6 + 5 \times \text{RM}10)$ **K1** $= \text{RM } 110$ **N1**	3	**10**

(b)



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