Solution	Marks	Remarks
1. $\dfrac{(x^{-3}y)^2 y^{-4}}{x^{-2}}$		
$=\dfrac{x^{-6}y^2y^{-4}}{x^{-2}}$	1M	for $(ab)^\ell = a^\ell b^\ell$ or $(a^h)^k = a^{hk}$
$= x^{-6-(-2)}y^{2+(-4)}$	1M	for $\dfrac{c^p}{c^q} = c^{p-q}$ or $\dfrac{c^p}{c^q} = \dfrac{1}{c^{q-p}}$
$= x^{-4}y^{-2}$		
$= \dfrac{1}{x^4y^2}$	1A	
	(3)	
2. $\dfrac{a}{a+1} = \dfrac{2}{b+1}$		
$a(b+1) = 2(a+1)$		
$ab + a = 2a + 2$	1M	
$ab - a = 2$	1M	for putting a on one side
$a(b-1) = 2$		
$a = \dfrac{2}{b-1}$	1A	or equivalent
	(3)	
3. **(a)** $2m^2 - 8n^2$		
$= 2(m^2 - 4n^2)$		
$= 2(m+2n)(m-2n)$	1A	or equivalent
(b) $3m - 2m^2 + 8n^2 - 6n$		
$= 3m - 6n - 2m^2 + 8n^2$		
$= 3m - 6n - (2m^2 - 8n^2)$		
$= 3(m-2n) - 2(m+2n)(m-2n)$	1M	for using the result of (a)
$= (m-2n)[3 - 2(m+2n)]$		
$= (m-2n)(3-2m-4n)$	1A	or equivalent
	(3)	
4. **(a)** $x - 2 \le 0$		
$x \le 2$	1A	
$x - \dfrac{3x+2}{2} < 2$		
$2x - (3x+2) < 4$		
$2x - 3x - 2 < 4$		
$-x < 6$		
$x > -6$	1A	
Therefore, we have $x \le 2$ and $x > -6$.		
Thus, the required range is $-6 < x \le 2$.	1A	

Solution	Marks	Remarks
(b) 4	1A	
	(4)	
5. **(a)** Let $y = \frac{k}{x^2}$, where k is a non-zero constant.	1A	
So, we have $45 = \frac{k}{2^2}$.	1M	for substitution
Solving, we have $k = 180$.	1A	
Thus, we have $y = \frac{180}{x^2}$.		
(b) $20 = \frac{180}{x^2}$		
$x^2 = 9$		
$x = \underline{\underline{3}}$ or $\underline{\underline{-3}}$	1A	
	(4)	
6. Let \$$C$ be the original cost price of the toy.		
Original selling price of the toy		
$= \$C \times (1 + 20\%)$		
$= \$1.2C$		
New cost price of the toy		
$= \$C \times (1 + 25\%)$		
$= \$1.25C$	1A	
New selling price of the toy		
$= \$(1.2C + 36)$	1A	
$1.25C \times (1 + 20\%) = 1.2C + 36$	1M	
$1.5C = 1.2C + 36$		
$0.3C = 36$		
$C = 120$	1A	
Thus, the original cost price of the toy is \$120.		
	(4)	
7. The maximum absolute error $= \frac{1}{2} \times 1\text{ cm}$		
$= 0.5\text{ cm}$		
The lower limit of the actual diameter of the semi-circle		
$= (8 - 0.5)\text{ cm}$	1M	for either one
$= 7.5\text{ cm}$		
The upper limit of the actual diameter of the semi-circle		
$= (8 + 0.5)\text{ cm}$		
$= 8.5\text{ cm}$		

Solution	Marks	Remarks
The lower limit of the actual area of the semi-circle $= \frac{1}{2} \times \pi \times \left(\frac{7.5}{2}\right)^2$ cm^2 $= 7.031\ 25\pi$ cm^2 $\approx 22.089\ 323\ 34$ cm^2	1A	
The upper limit of the actual area of the semi-circle $= \frac{1}{2} \times \pi \times \left(\frac{8.5}{2}\right)^2$ cm^2 $= 9.031\ 25\pi$ cm^2 $\approx 28.372\ 508\ 65$ cm^2	1A	
$\therefore$ $22.089\ 323\ 34$ cm^2 $\leq$ actual area of the semi-circle $< 28.372\ 508\ 65$ cm^2 Note that 30 cm^2 is not within the range of the actual area of the semi-circle. Thus, the claim is disagreed.	1A	f.t.
	(4)	
8. **(a)** $f(x) = (x^2 - 4)(x^{2018} + 2x^{2017}) + 3x + k$, where k is a constant.	1M	
$\because$ $f(x)$ is divisible by $x - 2$. $\therefore$ $f(2) = 0$	1M	
$\therefore$ $(2^2 - 4)(2^{2018} + 2 \times 2^{2017}) + 3(2) + k = 0$ $k = \underline{\underline{-6}}$	1A	
(b) Remainder $= f(-1)$	1M	
$= [(-1)^2 - 4][(-1)^{2018} + 2(-1)^{2017}] + 3(-1) - 6$ $= (-3)(-1) - 3 - 6$ $= \underline{\underline{-6}}$	1A	
	(5)	
9. Let x and y be the numbers of red balls and black balls respectively. $\begin{cases} \frac{x+1}{x+y+1} = \frac{1}{2} \\ \frac{y+1}{x+y+1} = \frac{3}{5} \end{cases}$	1A + 1A	
So, we have $\begin{cases} x = y - 1 \\ 3x - 2y - 2 = 0 \end{cases}$.		

Solution	Marks	Remarks
Therefore, we have $3(y-1)-2y-2=0$.	1M	for getting a linear equation in x or y only
Solving, we have $x=4$ and $y=5$.	1A	for both correct
The required probability $=\frac{4+1}{(4+1)+(5+1)}$		
$=\frac{5}{11}$	1A	
	(5)	
10. **(a)** Note that		
$\angle ADC+\angle BAD=180^\circ$ (int. $\angle$s, AB // DC).		
So, we have $\angle ADC=180^\circ-\theta$.	1A	
Also, note that		
$\angle CBA+\angle ADC=180^\circ$ (opp. $\angle$s, cyclic quad.).		
So, we have $\angle CBA+(180^\circ-\theta)=180^\circ$.		
Therefore, we have $\angle CBA=\theta$.	1A	
(b) $\because$ $\angle BAD=\angle CBA$ (proved in (a))		
$\therefore$ $\frac{\overset{\frown}{BCD}}{\overset{\frown}{ADC}}=\frac{\angle BAD}{\angle CBA}=\frac{1}{1}$ (arcs prop. to $\angle$s at $\odot^{ce}$)		
$\therefore$ $\overset{\frown}{BCD}=\overset{\frown}{ADC}$		
$\overset{\frown}{BC}+\overset{\frown}{CD}=\overset{\frown}{AD}+\overset{\frown}{CD}$		
$\therefore$ $\overset{\frown}{BC}=\overset{\frown}{AD}$		
Marking Scheme:		
Case 1 Any correct proof with correct reasons.	2	
Case 2 Any correct proof without reasons.	1	
(c) $\because$ $\overset{\frown}{AD}=\overset{\frown}{BC}$ (proved in (b))		
$\therefore$ $\angle AOD=\angle BOC$ (equal arcs, equal $\angle$s)	1M	
$=2\angle BAC$ ($\angle$ at centre twice $\angle$ at $\odot^{ce}$)		
Thus, the claim is agreed.	1A	f.t.
	(6)	

Solution	Marks	Remarks
11. **(a)** In $\triangle CBQ$ and $\triangle CDP$, $CB = CD$ (property of square) $\angle CBQ = 180° - \angle ABC$ (adj. $\angle$s on st. line) $= 180° - 90°$ (property of square) $= 90°$ $= \angle CDP$ (property of square) $BQ = DP$ (given) $\therefore$ $\triangle CBQ \cong \triangle CDP$ (SAS)		
Marking Scheme:		
Case 1 Any correct proof with correct reasons.	2	
Case 2 Any correct proof without reasons.	1	
(b) Note that $\angle BCD = 90°$ (property of square). So, we have $\angle BCP = 90° - \angle DCP$. Also, note that $\angle BCQ = \angle DCP$ (corr. $\angle$s, $\cong \triangle$s).		
So, we have $\angle PCQ = (90° - \angle DCP) + \angle BCQ$.	1M	
i.e. $\angle PCQ = 90°$ Thus, $\triangle CPQ$ is a right-angled triangle.	1A	f.t.
(c) $CP = CQ = 8\text{ cm}$ (corr. sides, $\cong \triangle$s) Area of right-angled triangle CPQ $= \frac{8 \times 8}{2}\text{ cm}^2$ $= 32\text{ cm}^2$ $PQ^2 = CP^2 + CQ^2$ (Pyth. theorem) $PQ = \sqrt{8^2 + 8^2}\text{ cm}$ $= \sqrt{128}\text{ cm}$ Let d cm be the shortest distance from C to PQ.		
$\frac{\sqrt{128} \times d}{2} = 32$	1M	
$d = \frac{64}{\sqrt{128}}$ Note that $\frac{64}{\sqrt{128}}\text{ cm} > 5\text{ cm}$. Thus, there is no point F on PQ such that the distance between F and C is 5 cm.	1A	f.t.
	(6)	

Solution	Marks	Remarks
12. **(a)** Let $\{a, b, c, d, e\}$ be the time taken by the girls, arranged in ascending order.		
The median of the time taken by the boys $= 7$ min		
The median of the time taken by the girls $= 8$ min		
So, we have $c = 8$.		
The mode of the time taken by the boys $= 8$ min		
The mode of the time taken by the girls $= 9$ min		
So, we have $d = e = 9$.		
The mean of the time taken by the boys $= 6$ min		
The mean of the time taken by the girls $= 7$ min		
Thus, we have $\frac{a+b+8+9+9}{5} = 7$.	1M	
Solving, we have $a + b = 9$.		
The inter-quartile range of the time taken by the girls		
$= \left(\frac{9+9}{2} - \frac{a+b}{2}\right)$ min		
$= \left(9 - \frac{9}{2}\right)$ min		
$= 4.5$ min	1A	
The inter-quartile range of the time taken by the boys		
$= (8 - 4)$ min $= 4$ min	1A	
Thus, the inter-quartile range of the time taken by the girls is not 1 minute more than that of the boys.	1A	f.t.
(b) The range of the time taken by the boys		
$= (8 - 2)$ min $= 6$ min	1A	
Thus, the range of the time taken by the girls is 7 min.		
So, we have $9 - a = 7$.		
Therefore, we have $a = 2$.	1A	for a, b both correct
Since $a + b = 9$, we have $b = 7$.		
The standard deviation of the time taken by the girls		
$\approx \underline{\underline{2.61 \text{ min}}}$	1A	
	(7)	

Solution	Marks	Remarks
13. (a) Let $x^2+y^2+Dx+Ey+F=0$ be the equation of C.		
Putting $x=0$, $y=2$ in C, we have $0^2+2^2+D(0)+E(2)+F=0$ Putting $x=4$, $y=0$ in C, we have $4^2+0^2+D(4)+E(0)+F=0$ Putting $x=9$, $y=5$ in C, we have $9^2+5^2+D(9)+E(5)+F=0$	1M	for substituting P, Q and R
So, we have $\begin{cases} 2E+F+4=0 \\ 4D+F+16=0 \\ 9D+5E+F+106=0 \end{cases}$.		
Solving, we have $D=-8$, $E=-10$ and $F=16$.	1A	
Thus, the equation of C is $x^2+y^2-8x-10y+16=0$.	1A	
(b) Centre of C $=\left(-\frac{(-8)}{2},-\frac{(-10)}{2}\right)=(4,5)$		
Radius of C $=\sqrt{\left(\frac{-8}{2}\right)^2+\left(\frac{-10}{2}\right)^2-16}=5$		
Distance between M and the centre of C		
$=\sqrt{(5-4)^2+(8-5)^2}$	1M	
$=\sqrt{10}$ <5		
Thus, M lies inside C.	1	
(c) (i) G, M and N are collinear.	1M	
(ii) The slope of the straight line which passes through M and N = the slope of the straight line which passes through M and G $=\frac{8-5}{5-4}$ $=3$		
The required equation is		
$y-5=3(x-4)$	1M	
$y-5=3x-12$		
$3x-y-7=0$	1A	or equivalent
	(8)	

Solution	Marks	Remarks
14. (a) $f(12)=12^3-96(12)-576$		
$=0$	1M	
$\therefore$ $x-12$ is a factor of $f(x)$.		
$\therefore$ $f(x)=\underline{\underline{(x-12)(x^2+12x+48)}}$	1A	
(b) (i) Let h_A cm and h_B cm be the depths of water of containers A and B after pumping water for 44 seconds respectively.		
Note that the corresponding radius of the water surface of container $A=\frac{9}{18}h_A$ cm $=\frac{h_A}{2}$ cm .		
So, we have		
$\frac{1}{3}\times\pi\times\left(\frac{h_A}{2}\right)^2\times h_A=2\pi\times 35$		
$\frac{h_A{}^3\pi}{12}=70\pi$		
$h_A{}^3=840$		
$h_A\approx 9.435\ 387\ 960$	1A	
Also, we have		
$\pi\times 4^2\times h_B=\pi\times 44$		
$h_B=2.75$	1A	
$\because$ $h_A>h_B$		
$\therefore$ The water level in container A is higher after pumping water for 44 seconds.	1A	f.t.
(ii) Let h cm be the depth of water when the water reaches the same level in the two containers.		
Note that the corresponding radius of the water surface of container $A=\frac{9}{18}h$ cm $=\frac{h}{2}$ cm .		
$\frac{\frac{1}{3}\times\pi\times\left(\frac{h}{2}\right)^2\times h-2\pi\times 35}{\pi}=\frac{\pi\times 4^2\times h-44\pi}{2\pi}$	1M	
$\frac{1}{12}h^3-70=8h-22$		
$h^3-96h-576=0$		
$(h-12)(h^2+12h+48)=0$	1M	for using the result of (a)

Solution	Marks	Remarks
Hence, we have $h-12=0$ or $h^2+12h+48=0$.		
Note that $h^2+12h+48=0$ has no real solutions.		
So, we have $h=12$.		
Thus, the depth of water when the water reaches the same level in the two containers is 12 cm.	1A	f.t.
	(8)	
15. **(a)** The required probability		
$=\dfrac{C_5^6}{C_5^{10}}$	1M	for numerator
$=\underline{\underline{\dfrac{1}{42}}}$	1A	r.t. 0.0238
Alternative Solution		
The required probability		
$=\dfrac{6}{10}\times\dfrac{5}{9}\times\dfrac{4}{8}\times\dfrac{3}{7}\times\dfrac{2}{6}$	1M	
$=\underline{\underline{\dfrac{1}{42}}}$	1A	r.t. 0.0238
(b) The required probability		
$=\dfrac{1}{42}+\dfrac{C_4^6C_1^4}{C_5^{10}}+\dfrac{C_3^6C_2^4}{C_5^{10}}$	1M	for $(a)+p_1+p_2$
$=\dfrac{1}{42}+\dfrac{5}{21}+\dfrac{10}{21}$		
$=\underline{\underline{\dfrac{31}{42}}}$	1A	r.t. 0.738
Alternative Solution		
The required probability		
$=1-\dfrac{C_2^6C_3^4}{C_5^{10}}-\dfrac{C_1^6C_4^4}{C_5^{10}}$	1M	for $1-p_3-p_4$
$=1-\dfrac{5}{21}-\dfrac{1}{42}$		
$=\underline{\underline{\dfrac{31}{42}}}$	1A	r.t. 0.738

Solution	Marks	Remarks
Alternative Solution		
The required probability		
$=\frac{1}{42}+C_1^5\times\frac{6}{10}\times\frac{5}{9}\times\frac{4}{8}\times\frac{3}{7}\times\frac{4}{6}+C_2^5\times\frac{6}{10}\times\frac{5}{9}\times\frac{4}{8}\times\frac{4}{7}\times\frac{3}{6}$	1M	for (a) $+\ p_5+p_6$
$=\frac{31}{42}$	1A	r.t. 0.738
	(4)	
16. Let m and σ be the mean and the standard deviation of the salaries respectively and x_1, x_2 be the salaries of Chris and John respectively.		
Note that the standard scores of Chris and John are 1 and −2 respectively.		
So, we have $\frac{x_1-m}{\sigma}=1$ and $\frac{x_2-m}{\sigma}=-2$.	1M	for either one
Solving, we have $\frac{x_1-x_2}{\sigma}=3$.		
Note that the difference in their salaries is \$3000.		
i.e. $x_1-x_2=3000$	1M	
So, we have $\frac{3000}{\sigma}=3$.		
Thus, we have $\sigma=1000$.	1A	
Variance of the distribution of the salaries		
$=\sigma^2$		
$=\$(1000^2)$		
$=\$1\,000\,000$	1A	
	(4)	

Solution	Marks	Remarks
17. **(a)** $f(x) = 24x - 2x^2$		
$= -2(x^2 - 12x)$		
$= -2(x^2 - 12x + 6^2) + 2(6^2)$	1M	
$= -2(x-6)^2 + 72$		
Thus, the coordinates of the vertex are (6, 72).	1A	
(b) **(i)** Note that $\triangle AEF \sim \triangle ACB$ (AAA).		
$\frac{AF}{AB} = \frac{EF}{CB}$ (corr. sides, $\sim \triangle$s)	1M	
$\frac{AF}{18\text{ cm}} = \frac{x\text{ cm}}{12\text{ cm}}$		
$AF = \frac{3}{2}x\text{ cm}$		
Hence, $ED = \left(18 - \frac{3}{2}x\right)\text{cm}$.	1A	
Area of rectangle *BDEF*		
$= x\left(18 - \frac{3}{2}x\right)\text{cm}^2$		
$= \underline{\underline{\left(18x - \frac{3}{2}x^2\right)\text{cm}^2}}$	1A	or equivalent
(ii) Area of rectangle *BDEF*		
$= \left(18x - \frac{3}{2}x^2\right)\text{cm}^2$		
$= \frac{3}{4}(24x - 2x^2)\text{ cm}^2$		
$= \frac{3}{4}[-2(x-6)^2 + 72]\text{ cm}^2$	1M	for using the result of (a)
$= \left[-\frac{3}{2}(x-6)^2 + 54\right]\text{cm}^2$		
The greatest value of the area of rectangle *BDEF* is 54 cm^2 < 60 cm^2.		
Thus, Peter's claim is disagreed.	1A	f.t.

<table>
<tr><th>Solution</th><th>Marks</th><th>Remarks</th></tr>
<tr><td>Alternative Solution
Assume that the area of rectangle $BDEF > 60\text{ cm}^2$.
$18x - \frac{3}{2}x^2 > 60$
$\frac{3}{2}(12x - x^2) > 60$
$12x - x^2 > 40$
$x^2 - 12x + 40 < 0$</td><td></td><td></td></tr>
<tr><td>$\Delta = (-12)^2 - 4(1)(40) = -16 < 0$</td><td>1M</td><td></td></tr>
<tr><td>Therefore, we have $x^2 - 12x + 40 > 0$.
This is impossible.</td><td></td><td></td></tr>
<tr><td>Thus, Peter's claim is disagreed.</td><td>1A</td><td>f.t.</td></tr>
<tr><td></td><td>(7)</td><td></td></tr>
<tr><td>18. (a) Consider $\triangle ABC$.
By cosine formula, we have</td><td></td><td></td></tr>
<tr><td>$\cos\angle ABC = \frac{AB^2 + BC^2 - AC^2}{2(AB)(BC)}$</td><td>1M</td><td></td></tr>
<tr><td>$\cos\angle ABC = \frac{29^2 + 92^2 - 75^2}{2(29)(92)}$
$\cos\angle ABC = \frac{20}{29}$
Consider right-angled triangle ABD.
$\cos\angle ABD = \frac{BD}{AB}$
$\frac{20}{29} = \frac{BD}{29\text{ cm}}$</td><td></td><td></td></tr>
<tr><td>$BD = \underline{\underline{20\text{ cm}}}$</td><td>1A</td><td></td></tr>
<tr><td>$AD = \sqrt{AB^2 - BD^2}$ (Pyth. theorem)
$= \sqrt{29^2 - 20^2}\text{ cm}$</td><td></td><td></td></tr>
<tr><td>$= \underline{\underline{21\text{ cm}}}$</td><td>1A</td><td></td></tr>
</table>

Solution	Marks	Remarks
Alternative Solution		
Consider $\triangle ABC$.		
By cosine formula, we have		
$\cos\angle ACB = \dfrac{AC^2 + BC^2 - AB^2}{2(AC)(BC)}$	1M	
$\cos\angle ACB = \dfrac{75^2 + 92^2 - 29^2}{2(75)(92)}$		
$\cos\angle ACB = \dfrac{24}{25}$		
Consider right-angled triangle ACD.		
$\cos\angle ACB = \dfrac{CD}{AC}$		
$\dfrac{24}{25} = \dfrac{CD}{75 \text{ cm}}$		
$CD = 72 \text{ cm}$		
$AD = \sqrt{AC^2 - CD^2}$ (Pyth. theorem)		
$= \sqrt{75^2 - 72^2}$ cm		
$= \underline{\underline{21 \text{ cm}}}$	1A	
$BD = BC - CD = (92 - 72) \text{ cm} = \underline{\underline{20 \text{ cm}}}$	1A	
(b) **(i)** Consider $\triangle ABC$.		
By cosine formula, we have		
$BC^2 = AC^2 + AB^2 - 2(AC)(AB)\cos\angle CAB$	1M	
$BC = \sqrt{75^2 + 29^2 - 2(75)(29)\cos 60^\circ}$ cm		
$BC = \sqrt{4291}$ cm		
Note that $CD = (92 - 20) \text{ cm} = 72 \text{ cm}$.		
Consider $\triangle BCD$.		
By cosine formula, we have		
$\cos\angle CDB = \dfrac{CD^2 + BD^2 - BC^2}{2(CD)(BD)}$	1M	
$\cos\angle CDB = \dfrac{72^2 + 20^2 - (\sqrt{4291})^2}{2(72)(20)}$		
$\angle CDB \approx 63.323\,128\,68^\circ$		
$\approx 63.3^\circ$		r.t. 63.3°
Note that $AD \perp BD$ and $AD \perp CD$.		
Hence, the required angle is 63.3°.	1A	f.t.

Solution	Marks	Remarks
(ii) Let P be the point on BD produced such that $CP \perp BD$. $\because$ The plane BCD is perpendicular to the horizontal ground. $\therefore$ CP is the height of the tetrahedron $ABCD$ with the base $\triangle ABD$. Consider right-angled triangle CDP. $\sin \angle CDP = \frac{CP}{CD}$ $CP \approx 72 \sin 63.323\,128\,68^\circ$ cm Volume of the tetrahedron $ABCD$ $= \frac{1}{3} \times$ area of $\triangle ABD \times CP$ $\approx \frac{1}{3} \times \frac{20 \times 21}{2} \times 72 \sin 63.323\,128\,68^\circ$ cm^3 $\approx 4503.505\,572$ cm^3 $\approx$ 4500 cm^3	 1M 1A (8)	 r.t. 4500 cm^3
19. (a) (i) Amount of donation on 31st December 2018 $= 50 \times 1.04 \times 0.1$ million dollars $= 5.2$ million dollars **(ii)** Amount of donation on 31st December 2021 $= 50 \times 1.04^4 \times 0.9^3 \times 0.1$ million dollars $= 4.264\,134\,451$ million dollars ≈ 4.26 million dollars **(b)** Total amount of donation $= \frac{50 \times 1.04 \times 0.1}{1 - 1.04 \times 0.9}$ million dollars $= 81.25$ million dollars < 85 million dollars Hence, the total amount of donation cannot exceed 85 million dollars.	 1A 1M 1A 1M 1A 1A	 for $S(\infty) = \frac{a}{1-r}$ f.t.

Solution	Marks	Remarks
(c) **(i)** Amount of donation on 31st December 2021		
$= \left\{ \begin{array}{l} \{[(50\times 1.04\times 0.9+60)\times \\ 1.04\times 0.9+60]\times \\ 1.04\times 0.9+60\}\times \\ 1.04\times 0.1 \end{array} \right\}$ million dollars	1M	
$= \left(\begin{array}{l} 50\times 1.04^4\times 0.9^3+ \\ 60\times 1.04^3\times 0.9^2+ \\ 60\times 1.04^2\times 0.9+ \\ 60\times 1.04 \end{array} \right)\times 0.1$ million dollars		
$\approx 21.811\,613\,49$ million dollars		
$\approx \underline{\underline{21.8 \text{ million dollars}}}$	1A	r.t. 21.8 million dollars
(ii) Let n be the required number of years.		
$\left[\begin{array}{l} 50\times 1.04^n\times 0.9^{n-1}+ \\ 60\times 1.04\times \dfrac{1-(1.04\times 0.9)^{n-1}}{1-1.04\times 0.9} \end{array} \right]\times 0.1>85$	1M	
$\left(\begin{array}{l} 0.32\times 1.04^n\times 0.9^{n-1}+6\times 1.04- \\ 6\times 1.04^n\times 0.9^{n-1} \end{array} \right)>5.44$		
$(1.04\times 0.9)^n<\dfrac{9}{71}$		
$n\log 0.936<\log\dfrac{9}{71}$	1M	
$n>\dfrac{\log\dfrac{9}{71}}{\log 0.936}$		
Solving, we have $n>31.228\,628\,17$.	1A	
$\therefore$ The amount of donation will first exceed 85 million dollars on 31st December 2049 (i.e. on 31st December of the 32th year).	1A	f.t.
	(12)	