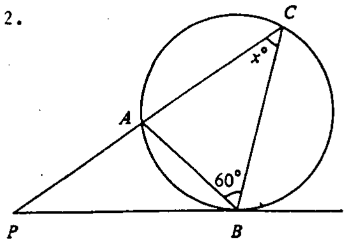
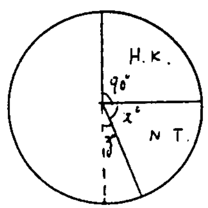
SOLUTIONS STEPS	MARKS	REMARKS
1. (a) $a^4 - 16 = (a^2-4)(a^2+4)$ or $(a-2)(a^3+2a^2+4a+8)$	1A	or $(a+2)(a^3-2a^2+4a-8)$
$= (a+2)(a-2)(a^2+4)$	1A	
$a^3 - 8 = (a-2)(a^2+2a+4)$	1A	
(b) L.C.M. $= (a+2)(a-2)(a^2+4)(a^2+2a+4)$	2A	
or $a^6 + 2a^5 + 4a^4 - 16a^2 - 32a - 64$ or $(a^3-8)(a+2)(a^2+4)$ or equivalent forms		If treated as equation, deduct 1 mark as pp.
2.  $\angle ABP = \angle C$ .... $= x°$	2A	
$\angle APB = \angle ABP$	1A	
$x°+x°+x°+60° = 180°$	1M	
$x = 40$	1A	Accept $x = 40°$ If a candidate wrote $\angle B = x$ etc., deduct 1 mark as pp.
(Syllabus A only)		
3. $3 = 2^3 - 2h + k$	1M	
$y' = 3x^2 - h$	1A	
$10 = 12 - h$	1M	For sub. y' and x
$h = 2$	1A	
$k = -1$	1A	
(Syllabus B only)		
3. $(2^x)^2 - 3(2^x) - 4 = 0$ or $y^2 - 3y - 4 = 0$ where $y = 2^x$	1M	
$(2^x-4)(2^x+1) = 0$ or $(y-4)(y+1) = 0$	1A	
$2^x = 4$ or -1	1A	Accept $2^x = 4$ if answer is correct.
Rejecting $2^x = -1$	1A	This can be omitted.
$x = 2$	1A	
NOTE: If answer is obtained by trial and error method, award 1A for the answer only.		
4. $f(1) = 0$	1M	This can be omitted.
$a + b - 1 = 0$	1A	
$f(-1) = 4$	1M	
$a - b - 1 = 4$	1A	
Solving, $a = 3$	1A	
$b = -2$	1A	

ALTERNATIVELY : In long division,	MARKS	ALTERNATIVELY :	
$f(x) = (x-1)(ax+a+b) + (b+a-1)$		$f(x) = (x-1)(ax+1)$	1A
$a + b - 1 = 0$	1M+1A	$f(-1) = 4$	1M
$f(x) = (x+1)(ax+b-a) + (a-b-1)$		$(-2)(-a+1) = 4$	1A
$a - b - 1 = 4$	1M+1A	$a = 3$	1A
$a = 3$	1A	$b = -2$	1M+1A
$b = -2$	1A		

SOLUTIONS STEPS	MARKS	REMARKS
5. (a) $\alpha + \beta = -k$	1A	This can be omitted.
$(\alpha+2) + (\beta+2) = -k + 4$	1A	
$\alpha\beta = 1$	1A	This can be omitted.
$(\alpha+2)(\beta+2) = \alpha\beta + 2(\alpha+\beta) + 4$ $= 5 - 2k$	1A	
(b) $p = k - 4$	1M	ALTERNATIVELY : $[(x-(\alpha+2)][x-(\beta+2)]=0$ 1M $x^2 + (k-4)x + 5 - 2k = 0$
$q = 5 - 2k$	1M	$p = k - 4$, $q = 5 - 2k$ } 1A
6. $2\tan^2\theta = 1 - \tan\theta$ $2\tan^2\theta + \tan\theta - 1 = 0$ $(2\tan\theta - 1)(\tan\theta + 1) = 0$	1M+1A	
$\tan\theta = \frac{1}{2}$ or -1		
$\theta = 27°, 207°, 135°, 315°$	1A+1A +1A+1A	Accept $\theta = 27$, etc. Do not accept answers in radians.
(i) General solution, no marks. (ii) If more than 4 answers given, deduct one mark for each wrong answer from the marks obtained in the answer only.		If $\theta = 26°33'$, 0 marks. If $\theta = 26°33'$, $206°33'$ 1 marks. If $\theta = 26°33'$, $206°33'$, $315°$ 2 marks
7. Total number of accidents		ALTERNATIVELY : Kowloon — y°
$= 4200 \times \frac{360}{90}$	1A	$y = 90 \times \frac{9240}{4200}$ 1A
$= 16\ 800$	1A	$= 198$ 1A
$= 16\ 800 - 4200 - 9240$	1M	$x = 360 - 198 - 90$ 1M
$= 3360$	1A	$= 72$ 1A
$x = \frac{3360}{16\ 800} \times 360$	1M	$n = 4200 \times \frac{72}{90}$ 1M
$= 72$ (Accept $x = 72°$)	1A	$= 3360$ 1A

ALTERNATIVELY :

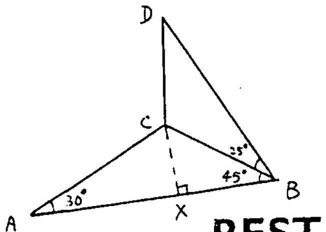


z° — N accidents.	
$N = 9240 - 4200 - 4200$	1A
$= 840$	1A
$n = 4200 - 840$	1M
$= 3360$	1A
$x = \frac{3360}{4200} \times 90$	1M
$= 72$	1A

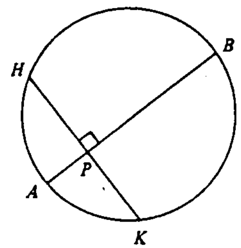
NOTES :

(1) For answers without units, do not deduct marks.
(2) For answers with wrong units, deduct one mark for the whole question from the marks scored in the answers (not as pp.).

SOLUTIONS STEPS	MARKS	REMARKS
(a) (5 marks)		
$\frac{BC}{\sin A} = \frac{AB}{\sin C}$ or $\frac{a}{\sin A} = \frac{c}{\sin C}$	1M	For sine formula.
$\frac{BC}{\sin 30°} = \frac{100}{\sin 105°}$	1A	
$BC = \frac{100 \sin 30°}{\sin 105°}$		
≈ 51.8 (m)	1A	
$\frac{AC}{\sin 45°} = \frac{100}{\sin 105°}$ or $\frac{AC}{\sin 45°} = \frac{BC}{\sin 30°}$	1M	
AC ≈ 73.2 (m)	1A	
ALTERNATIVELY:		
$AC^2 = BC^2 + AB^2 - 2BC(AB)\cos 45°$	1M	
AC ≈ 73.2 (m)	1A	
(b) (7 marks)		
If the answers in this part are not rounded off to the required degree of accuracy, deduct one mark for part (b) from the marks scored in the answers (not as pp.).		
(i) $\tan 25° = \frac{CD}{BC}$	1M	
CD = BC tan 25°		
≈ 24.1 (m)	1A	Accept 24.1 to 24.2
(ii)(1) $\sin 45° = \frac{CX}{BC}$ or $\sin 30° = \frac{CX}{AC}$	1M	
CX = BC sin 45° or AC sin 30°		
≈ 36.6 (m)	1A	Accept 36.5 to 36.7
ALTERNATIVELY:		
$\frac{1}{2}\,100(CX) = \frac{1}{2}\,AC\,(BC)\,\sin 105°$	1M	
CX ≈ 36.6 (m)	1A	
(2) $\tan \angle DXC = \frac{CD}{CX}$	2M	
$\angle DXC \approx 33°$	1A	Accept 33° to 34°



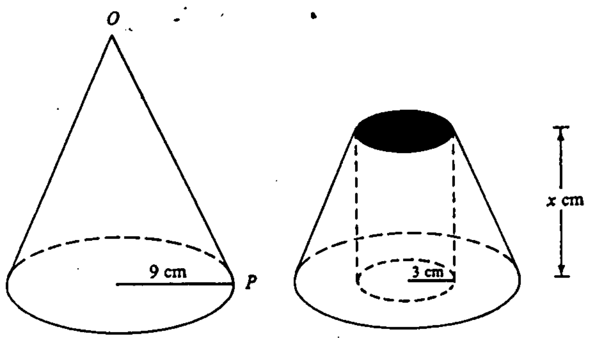
SOLUTIONS STEPS	MARKS	REMARKS
9. (a) (3 marks)		
Centre : (4.5 , 2.5)	1A	
Radius $= \frac{1}{2}\sqrt{(7-2)^2+(5-0)^2}$ or $\sqrt{(7-4.5)^2+(5-2.5)^2}$	1A	or $\sqrt{(4.5-2)^2+(2.5-0)^2}$
$= \frac{5\sqrt{2}}{2}$		
$(x-4.5)^2 + (y-2.5)^2 = \frac{50}{4}$	1M	
or $x^2 + y^2 - 9x - 5y + 14 = 0$		
ALTERNATIVELY:		
$\frac{y-0}{x-2} \cdot \frac{y-5}{x-7} = -1$	2A	
$x^2 + y^2 - 9x - 5y + 14 = 0$	1A	
or $(x-2)(x-7) + y(y-5) = 0$		
(b) (2 marks)		
Coordinates of P :		
$x_1 = \frac{(1)(7) + (4)(2)}{5}$		
$= 3$	1A	
$y_1 = \frac{(1)(5) + (4)(0)}{5}$		
$= 1$	1A	
(c) (7 marks)		
(i) slope of AB = 1		
HPK : $\frac{y-1}{x-3} = -1$	1M	
$x + y - 4 = 0$	1A	
(ii) Sub. $y = 4 - x$ in equation of circle	1M	Sub. $x = 4 - y$ in eqt. of circle 1M
$x^2 + (4-x)^2 - 9x - 5(4-x) + 14 = 0$ $2x^2 - 12x + 10 = 0$ ...... $x^2 - 6x + 5 = 0$ $x = 1$ or 5	2A	$2y^2 - 4y - 6 = 0$ ....2A $y^2 - 2y - 3 = 0$ $y = -1$ or 3
The coordinates of H and K are (1, 3) and (5, −1)	1A+1A	Accept $\begin{cases} x = 1 \\ y = 3 \end{cases}$ and $\begin{cases} x = 5 \\ y = -1 \end{cases}$ If a candidate only wrote $x = 1$ or 5, $y = 3$ or -1 no marks.



SOLUTIONS STEPS	MARKS	REMARKS
10. (6 marks)		
(a) (i) $n(S) = 36$	1A	
$n(E) = 6$	1A	
Required probability		
$= \frac{6}{36}$ or $\frac{1}{6}$	1A	or 0.17
(ii) Required probability		
$= \frac{4+6}{36}$	2A	For numerator
$= \frac{10}{36}$ or $\frac{5}{18}$	1A	or 0.28
ALTERNATIVELY:		
(ii) Required probability		
$= \frac{6}{36} + \frac{6}{36} - \frac{2}{36}$	2A	
$= \frac{10}{36}$ or $\frac{5}{18}$	1A	
(b) (6 marks)		
(i) The probability of losing 1 point		
$= 1 - \frac{10}{36}$ or $1 - \frac{5}{18}$	1M	
Required probability		
$= (1-\frac{10}{36})(1-\frac{10}{36})$ or $(1-\frac{5}{18})(1-\frac{5}{18})$	1M	
$= \frac{676}{1296}$ or $\frac{169}{324}$	1A	or 0.52 or $\frac{338}{648}$
(ii) He gains 1 point if he wins once & loses once.		
The required probability		
$= 2 \times \frac{10}{36} \times \frac{26}{36}$ or $2 \times \frac{5}{18} \times \frac{13}{18}$	1M+1A	ALTERNATIVELY : $1 - (\frac{10}{36})^2 - (\frac{26}{36})^2$ 1M+1A
$= \frac{520}{1296}$ or $\frac{65}{162}$ (or 0.40)	1A	$= \frac{520}{1296}$ or $\frac{65}{162}$ 1A

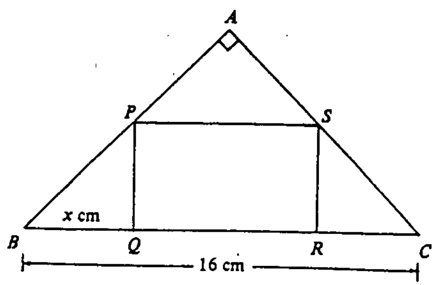
If "required probability" or "P" is omitted in all parts, deduct one marks as pp.

SOLUTIONS STEPS	MARKS	REMARKS
or answer(s) with no units or wrong units, deduct one mark for the whole question from the marks scored in the answers (not as pp.).		
(5 marks)		
(i) $\pi \times 9 \times OP = 135\pi$	1A	
$OP = 15$ cm	1A	
(ii) Let the height = h cm		
$h^2 + 9^2 = OP^2$	1M	
$h^2 + 9^2 = 15^2$	1A	
$h = 12$ (cm)	1A	
marks)		
(i) $\frac{12-x}{12} = \frac{3}{9}$	2M	
$x = 8$	1A	ALTERNATIVELY :
(ii) Volume of smaller cone		Volume of the frustum
$= \frac{1}{3}\pi(3)^2 \times 4$ cm^3	1M	$\frac{1}{3}\pi(3^2+9^2+3\times9)\times8$cm^3 .. 1M
		$= 312\pi$ cm^3
Volume of cylinder $= \pi(3)^2 \times 8$ cm^3	1M	Volume of cylinder $= \pi(3)^2 8$ cm^3 .... 1M
Volume of the solid		
$= [\frac{1}{3}\pi(9)^2 \times 12 - \frac{1}{3}\pi(3)^2 \times 4 - \pi(3)^2 8]$ cm^3	1M	Volume of the solid $= [312\pi - \pi(3)^2 8]$ cm^3 1M
$= (324\pi - 12\pi - 72\pi)$ cm^3		$= (312\pi - 72\pi)$ cm^3
$= 240\pi$ cm^3	1A	$= 240\pi$ cm^3 .... 1A

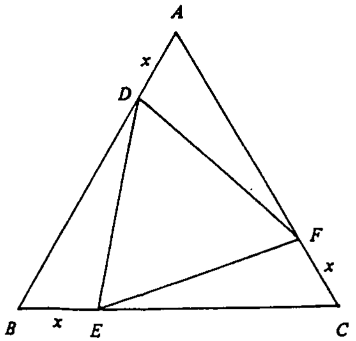


SOLUTIONS STEPS	MARKS	REMARKS
1. (Syllabus A only)		
(a) (7 marks)		
(i) $x^3 + x - 1 = 0$		
add $y = 1$	1A	This may be omitted.
graph of $y = 1$	1A	Labelling may be omitted.
From the graph, $x = 0.7$	1A	
(ii) Consider $y = x^3 + x - 1$		
Testing for change of sign of $x^3 + x - 1$	1M	
x: 0.69, y: + ; x: 0.68, y: − }	1A	
x: 0.683 – 0.685, y: + ...	1A	
$x = 0.68$	1A	
ALTERNATIVELY:		
Graphical method:		
First graph (magnified)	1M	
Point of intersection lies between 0.68 to 0.69	1A	
Second graph (magnified)		
Point of intersection lies between 0.680 to 0.685	1A	
$x = 0.68$	1A	
(b) (i) (5 marks)		
$(x + 1)^4 - (x - 1)^4$		
$=(x^4+4x^3+6x^2+4x+1) - (x^4-4x^3+6x^2-4x+1)$	1A+1A	ALTERNATIVELY :
$= 8x^3 + 8x$	1A	$(x + 1)^4 - (x - 1)^4$
		$=[(x+1)^2-(x-1)^2][(x+1)^2+(x-1)^2]$ 1A
		$=4x(2x^2 + 2)$ 1A
		$=8x^3 + 8x$ 1A
(ii) $(x + 1)^4 - (x - 1)^4 = 8$		
$8x^3 + 8x = 8$		
$x^3 + x - 1 = 0$		
From (b), the root equals to 0.68	2M	

SOLUTIONS STEPS	MARKS	REMARKS
12. (Syllabus B only)		
(a) (2 marks)		
PQ or RS = x cm or QR or PS = (16 −2x) cm	1A	This may be omitted if next line is correct.
Area of PQRS $= x(16 - 2x)$ $= 16x - 2x^2$	1A	
(b) (5 marks)		
(i) Greatest area : $x = 4$	1A	
(ii) $y = 14$	2A	
$x = 2.6$ or 5.4	1A+1A	No marks if answers are obtained by calculations
(c) (5 marks)		
(i) PQRS − 4△PBQ = 8	1M	
$(16x - 2x^2) - 4(\frac{1}{2} x^2) = 8$	1A	
$x^2 - 4x + 2 = 0$		
(ii) $8x - x^2 = 2 + 4x$		
$y = 2 + 4x$ or Graph of the line $y = 2 + 4x$ }	1A	For either equation of line or graph or both. Labelling may be omitted.
$x = 0.6$ or 3.4	1A+1A	Accept $x = 0.5$



SOLUTIONS STEPS	MARKS	REMARKS
3. (a) (3 marks)		
$DE^2 = BD^2 + BE^2 - 2(BD)(BE)\cos\angle DBE$	1M	This may be omitted.
$DE^2 = (2-x)^2 + x^2 - 2(2-x)(x)\cos 60°$	1A	
$= 3x^2 - 6x + 4$	1A	
ALTERNATIVELY:		
Area of $\Delta DBE = \frac{1}{2}(x)(2-x)\sin 60°$	1A	
Area of $\Delta ABC = \frac{1}{2}(2)(2)\sin 60°$		
Area of $\Delta DEF = \frac{1}{2}(DE)^2\sin 60°$		
$\frac{1}{2}(DE)^2\sin 60° = \frac{1}{2}(2)(2)\sin 60° - 3(\frac{1}{2}x)(2-x)\sin 60°$	1M	
$DE^2 = 4 - 3x(2-x)$		
$= 3x^2 - 6x + 4$	1A	
(b) (5 marks)		
$\Delta DEF = \frac{1}{2} DE^2 \sin 60°$	1M	
$= \frac{\sqrt{3}}{4}(3x^2 - 6x + 4)$	1	
$\Delta DEF = \frac{3\sqrt{3}}{4}(x^2 - 2x + \frac{4}{3})$		
$= \frac{3\sqrt{3}}{4}[(x-1)^2 + \frac{1}{3}]$	1A+1M	
For smallest area, $x = 1$	1A	
(c) (4 marks)		
$\frac{\sqrt{3}}{4}(3x^2 - 6x + 4) \leqslant \frac{\sqrt{3}}{3}$	1	This may be omitted if answer correct.
$9x^2 - 18x + 12 \leqslant 4$		
$9x^2 - 18x + 8 \leqslant 0$	1A	For correct quadratic expression.
$(3x-2)(3x-4) \leqslant 0$	1A	For correct factorization.
$\frac{2}{3} \leqslant x \leqslant \frac{4}{3}$	1A	Accept $a \leqslant x \leqslant b$ where $a = 0.6$ to 0.7, $b = 1.3$ to $\frac{4}{3}$



SOLUTIONS STEPS	MARKS	REMARKS
14. (a) (5 marks)		
(i) $Q_1 = \frac{1}{3}P(1 + r\%)$	1A	
Sum of money at the beginning of the 2nd year		
$= 2Q_1$ or $P(1 + r\%) - Q_1$ or $\frac{2}{3}P(1 + r\%)$	1M	or $P(1+r\%) - \frac{1}{3}P(1+r\%)$
$Q_2 = \frac{1}{3} \times 2Q_1(1 + r\%)$		
$= \frac{2}{9}P(1 + r\%)^2$	1A	
(ii) Sum of money at the beginning of the 3rd year		
$= \frac{4}{9}P(1 + r\%)^2$		
$Q_3 = \frac{1}{3} \times \frac{4}{9}P(1 + r\%)^3$		
$= \frac{4}{27}P(1 + r\%)^3$	2	
(b) (2 marks)		
Common ratio $= \frac{Q_2}{Q_1}$ or $\frac{Q_3}{Q_2}$	1M	Using Q_1 , Q_2 from above.
$= \frac{2}{3}(1 + r\%)$	1A	
(c) (5 marks)		
(i) $\frac{4}{27}P(1 + r\%)^3 = \frac{27}{128}P$		
$(1 + r\%)^3 = \frac{27^2}{4 \times 128}$	1A	
$r = 12.5$	1A	
(ii) $Q_1 = \frac{1}{3}P(1 + r\%)$		
$= \frac{10\ 000}{3}(1.125)$		
$= 3750$		
Common ratio $= \frac{2}{3}(1 + r\%)$		
$= 0.75$		
$Q_1 + Q_2 + \ldots + Q_{10} = \frac{3750(1 - 0.75^{10})}{(1 - 0.75)}$	1M+1A	1M For $S_n = \frac{a(1 - R^n)}{1 - R}$
$\approx 14\ 155$	1A	