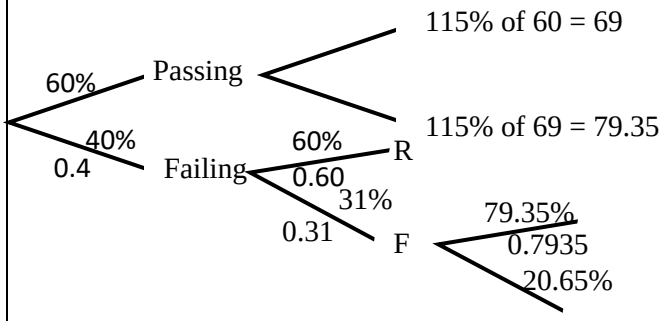
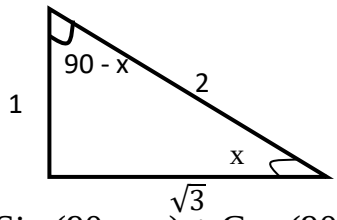
FORM 3 EXAM
MATHEMATICS PAPER 231/1
MARKING SCHEME

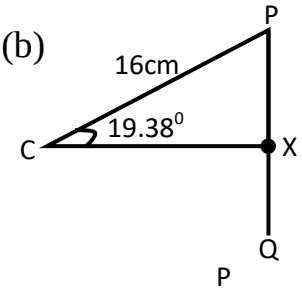
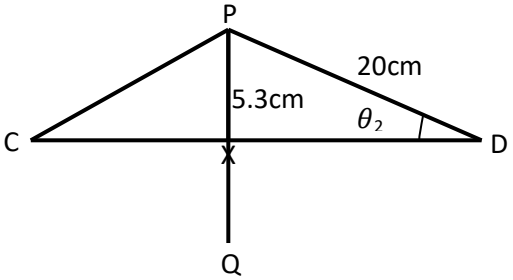
No.			
1.	Numerator $\sqrt{\frac{1}{4}}$ of $\frac{7}{2} + \frac{3}{2}(\frac{15-4}{6})$ $\frac{1}{2}$ x $\frac{7}{2}$ x $\frac{3}{2}$ x $\frac{11}{6}$ $\frac{7}{4} + \frac{33}{12} = \frac{21+33}{12} = \frac{54}{12}$ Denominator $\frac{3}{4}$ of $\frac{5}{2} \div \frac{1}{4}$ $\frac{15}{8}$ x $\frac{4}{1} = \frac{5}{12}$ $\frac{54}{12} \div \frac{15}{2}$ $\frac{54}{6}\ x\ \frac{2}{15} = \frac{3}{5}$ $= \frac{3}{5}$	M1 M1 A1	
		3 Marks	
2.	L.C.M. 10x $\frac{x+1}{2}$ x 10x – $\frac{3}{x}x10x = \frac{x-2}{5}\ x\ 10x$ 5x(x + 1) – 30 = 2x(x – 2) $5x^2 + 5x – 30 = 2x^2 – 4x$ $3x^2 + x – 30 = 0$ $3x^2 + 10x – 9x – 30 = 0$ (10,-9) x(3x + 10)-3(3x + 10) = 0 (x – 3) (3x + 10) = 0 x – 3 = 0 $\Rightarrow$ = 3 3x + 10 = 0 $\Rightarrow \frac{-10}{3}$	M1 x by 10x M1 factors A1	
		3 Marks	
3.	$T_1 = 10 + 0d = 10$ $T_3 = 10 + 2d$ $T_T = 10 + 6d$ $\frac{10+2d}{10} = \frac{10+6d}{10+2d}$ $(10 + 2d)(10 + 2d) = 10(10 + 6d)$ $100 + 40d + 4d^2 = 100 + 60d$ $60d = 40d + d^2$ $4d^2 = 20d$ d = 5	B1 M1 A1	
		3 Marks	

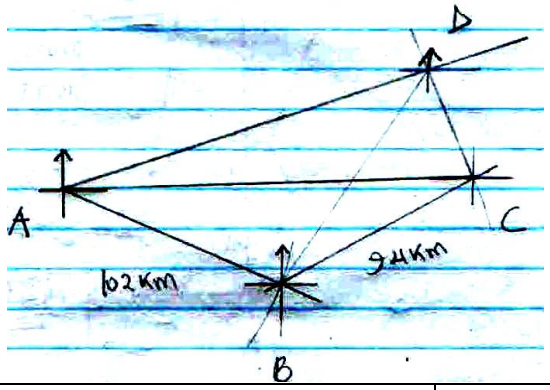
4.	$\text{Log}_2 y\ 2 = \text{Log}_2 92$ $\text{Log}_2 y - \text{Log}_2 92 = 2$ $\text{Log}_2 (\frac{y}{92}) = 2$ $\Rightarrow \frac{y}{92} = 2^2$ $y = 4 \times 92$ $y = 368$	M1 M1 A1	
		3 Marks	
5.	$\frac{2\sqrt{3}}{(\sqrt{3}+\sqrt{2})} \frac{(\sqrt{3}-\sqrt{2})}{(\sqrt{3}-\sqrt{2})}$ $= \frac{2\sqrt{3}x\sqrt{3}-2\sqrt{3}x\sqrt{2}}{(\sqrt{3})^2-(\sqrt{2})^2}$ $= \frac{2x3-2\sqrt{6}}{3-2}$ $= \frac{6-2\sqrt{6}}{1}$ $= 6 - 2\sqrt{6}$	M1 M1 A1	
		3 Marks	
6.	Men Days Hours 40 60 9 ? 48 10 No. of men to work 48 days 10 hrs $= \frac{40\ x\ 60\ x\ 9}{48\ x\ 10}$ $= 45$ $= 45 - 40 = 5$ Men	M1 A1 B1	
		3 Marks	
7.	Mean – of six $\frac{n}{2}, \frac{n}{2} + 1$ 32, x Median 36 $= \frac{32+x}{2}$ $72 = 32 + x$ $72 - 32 = x$ $40 = x$ Mean mark $= \underline{24 + 28 + 32 + 40 + 48 + 50}$ 6 $\overline{x} = 37$	M1 M1 A1	
		3 Marks	
8.	Absolute error $= \frac{Max-Working+Working-Min}{2}$ $= \frac{20.05x\ 25.05-19.95\ x\ 24.95}{2}$ $= \frac{4.5}{2}$ 2.25	M1	

	% error = $\frac{Absolute}{Actual}$ x 100 = $\frac{2.25}{20.0\ x\ 25.0}$ x 100 = 0.45%		
9.	P(1,-2) m T n Q(4,10) 2 1 OT = $\frac{m}{m+n}$ (OQ) + $\frac{m}{m+n}$ (OP) = $\frac{2}{3}\begin{pmatrix}4\\10\end{pmatrix} + \frac{1}{3}\begin{pmatrix}1\\-2\end{pmatrix}$ = $\begin{pmatrix}\frac{8}{3}\\\frac{20}{3}\end{pmatrix} + \begin{pmatrix}\frac{1}{3}\\\frac{-2}{3}\end{pmatrix}$ = $\begin{pmatrix}\frac{9}{3}\\\frac{18}{3}\end{pmatrix} = \begin{pmatrix}3\\6\end{pmatrix}$ T(3,6)	M1 A1	
10.	 P (Second or third) = P(FP) or P(FFP) = 0.4 x 0.69 + 0.4 x 0.31 x 0.7935 = 0.276 + 0.098394 = 0.374394		M1 M1M1 M1 A1
11.	$\frac{2w(x-2)^2}{y+1}$ X = 3 Y = 3 + 3 = 6 W = 2 x 3 + 6 = 6 + 6 = 12 $\therefore \frac{2\ x\ 12(3-2)^2}{6+1}$ $\frac{24\ x\ 1^2}{7} = \frac{24}{7}$	x = 3, y = x + 3 and w = 2x + y M1 A1	
		2 Marks	

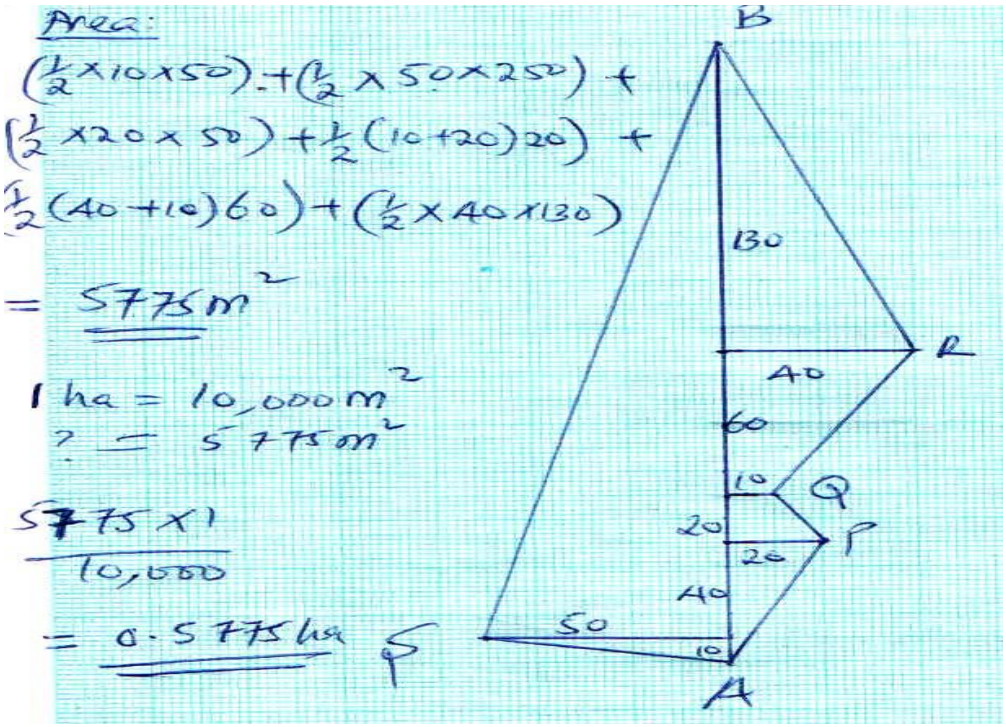
12.	The 1st 25000 = 2500 x $\frac{2}{100}$ = 500/= Next 25000 = 25000 x $\frac{2.5}{100}$ = 625/= Reamaining 15,000 = 15000 x $\frac{5}{100}$ = 750/= Total commission = 500 + 625 + 750 = 1875/= Weekly pay 1500 + 1875 = 3375/=		
13.	Cost of mixture $\Rightarrow \frac{31.20x\ 100}{120}$ = Sh. 26 $\left(\frac{A}{A+B}\right)25 + \left(\frac{A}{A+B}\right)28 = 26$ 25A + 28B = 26A + 26B $\frac{2B}{B} = \frac{A}{B}$ $\frac{A}{B} = \frac{2}{1}$ $\therefore$ A : B = 2:1	M1 M1 M1 A1	
		4 Marks	
14.	A.S.F = 108:12 = 9:1 L:S:F = $\sqrt{A.S.F}$ or A.S.F = (L.S.F)^2 L:S:F = 3 :1 (L:S:F)3 = V.S.F V.S.F = 27:1 Volume of smaller = $\frac{1}{27}$ x 810 = 30cm^3	M1 M1 A1	
15.	 Sin (90 – x) + Cos (90 – x) = $\frac{\sqrt{3}}{2} + \frac{1}{2}$ = $\frac{\sqrt{3}+1}{2}$	B1 M1 A1	
		3 Marks	
16.	Sum = (2n – 4)90 = 1260 2n – 4 = 14 $\frac{2n}{2} = \frac{18}{2}$ n = 9 (No. of sides) Size of exteruior = $\frac{360}{n}$ = $\frac{360}{9}$ = 40^0	M1 M1 A1	

17.	(a) Let the group members be x Originally, each member was to contribute $\frac{2{,}000{,}000}{x}$ After withdrawal of 40 members, each member had to contribute. $\frac{2{,}000{,}000}{x-40}$ But, the same amount was to be raised despite the number of members. Therefore: $\frac{2{,}000{,}000}{x} = \frac{2{,}000{,}000}{x-40} - 2500$ $(x-4)\frac{2{,}000{,}000}{x} = \frac{2{,}000{,}000}{x-40} \times (x-4) - x(x-4)(2500)$ $2{,}000{,}000x - 8{,}000{,}000 = 2{,}000{,}000x - 2500x^2 + 100000x$ $25x^2 - 1000x - 800{,}000 = 0$ $x^2 - 40x - 32{,}000 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $= \frac{40 \pm \sqrt{1600 + 4 \times 32{,}000}}{2}$ X = 200 or – 160 Original no. of members = 200 (b) Fund from CDF = $\frac{45}{100}$ X 2,000,000 = 900,000 Amount remaining to be contributed 2,000,000 – 900,000 = 1,100,000 Amount contributed by each member = $= \frac{1{,}100{,}000}{160}$ = 6875/=		
18.	a = $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ b = $\begin{pmatrix} 14 \\ 1 \end{pmatrix}$ (a) $2\underset{\sim}{a} + 3\underset{\sim}{b}$ = $2\begin{pmatrix} 3 \\ -4 \end{pmatrix} + 3\begin{pmatrix} 14 \\ 1 \end{pmatrix}$ $\begin{pmatrix} 6 \\ -8 \end{pmatrix} + \begin{pmatrix} 42 \\ 3 \end{pmatrix} = \begin{pmatrix} 48 \\ -5 \end{pmatrix}$ (b) $\frac{1}{2}\begin{pmatrix} 3 \\ -4 \end{pmatrix} - \begin{pmatrix} 14 \\ 1 \end{pmatrix} = \begin{pmatrix} \frac{3}{2} \\ -1 \end{pmatrix} - \begin{pmatrix} 14 \\ 1 \end{pmatrix}$ $= \begin{pmatrix} -12\frac{1}{2} \\ -1 \end{pmatrix}$	M1A1 M1 A1	

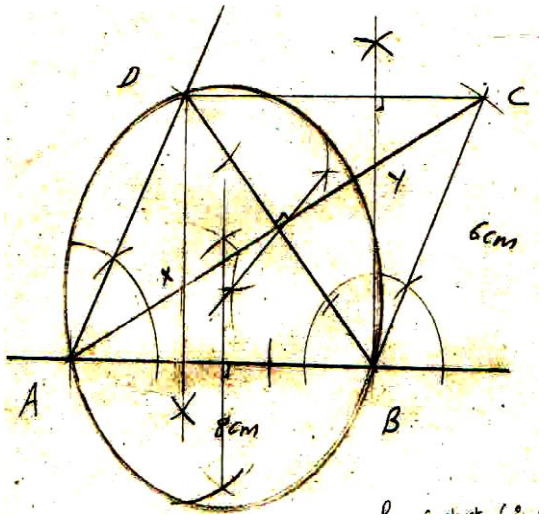
	c) Given $x\underset{\sim}{a} - yb = \begin{pmatrix}-13\\-22\end{pmatrix}$ Form a simultaneous equation hence find x and y (6 Marks) Using substitution and elimination. $x\begin{pmatrix}3\\-4\end{pmatrix} - y\begin{pmatrix}14\\1\end{pmatrix} = \begin{pmatrix}-13\\-18\end{pmatrix}$ (i) $3x - 14y = -13$ (ii) $-4x - y = -22$ from (i) $3x = -13 + 14y$ $x = \frac{13+14y}{3}$ $-4\left(\frac{-13+14y}{3}\right) - y = -22$ $52-56y - 3y = -66$ $-59y = -118$ $y = 2$ $3x - 14y = -13$ $3x - 14 \times 2 = -13$ $3x = -13 + 28$ $3x = 15$ $x = 5$	M1 M1 M1 A1 M1 A1	
19.	(a) Area $= \frac{1}{2}ab\sin\theta$ $80.14cm^2 = \frac{1}{2}(16 \times 16)\sin\theta$ $\sin\theta = \frac{80.14}{128}$ $\sin\theta = 0.6261$ $\theta = \sin^{-1}0.6261$ $= 38.76^0$ (b)   	$\sin 19.38 = \frac{PX}{16cm}$ $PX = 16\sin 19.38^0$ $= 5.3cm^3$ $\sin\theta_2 = \frac{5.3cm}{20cm}$ $\theta_2 = 15.37 \times 2$ $= 30.73^0$	

	(c) Area of shaded region $\left[\frac{22}{7}x16^2\ x\ \frac{38.76}{360} - \frac{1}{2}x16^2 Sin38.76\right]$ $+\left[\frac{22}{7}\ x\ 20^2\ x\ \frac{30.73}{360} - \frac{1}{2}\ x\ 20^2 Sin\ 30.73^0\right]$ =(86.626 – 80.136) + (107.311 – 102.199) 6.49 + 5.112 = 11.602cm^2		
20.	(a) $\frac{x}{x+4} = \frac{2.1}{4.9}$ 4.9x = 2.1x + 8.4 x = 3cm Height = 3cm +4cm = 7cm (b) $A = \pi r^2 = \left(\frac{22}{7}\ x\ 4.9\ x\ 4.9\right)$ x 2 = 150.92cm^2 Area of frustrum Slant $\sqrt{7^2 + 4.9^2}$ = 8.545cm (Big cone) $\sqrt{2.1^2 + 3^2}$ = 3.662cm (Small cone) =($\frac{22}{7}$ x 49 x 8.545)–($\frac{22}{7}$ x 2.1 x 3.662) 131.593 – 24.1692 107.4238cm^2 Total surface area = 150.92 + 107.4238 = 258.34cm^2 volume of hemisphere $\frac{2}{3}$x $\frac{22}{7}$ x 4.93 = 246.5 cm^3 Volume of frustrum: $\frac{1}{3}$ x $\frac{22}{7}$ x 4.92 x 7) – ($\frac{1}{3}$ x $\frac{22}{7}$ x 2.1^{2}x3) 176.07 – 13.86 = 162.21cm^3		
21.	(a) 		
	(b) Bearing of town B from town D = $212^0 \pm 1^0$ Bearing of town A from C = $268^0 \pm 1^0$ (c) Distance AC = 9cm x 20km = 180km BD = 5.4cm x 20km = 108km		

22.



23.



B1 – Construct 600 at A
B1 – Construct 1200 at B
B1 – Completion of parallelogram
B1 – Drop the perpendicular
B1 – Locating X
Xy = 5.5cm±0.1

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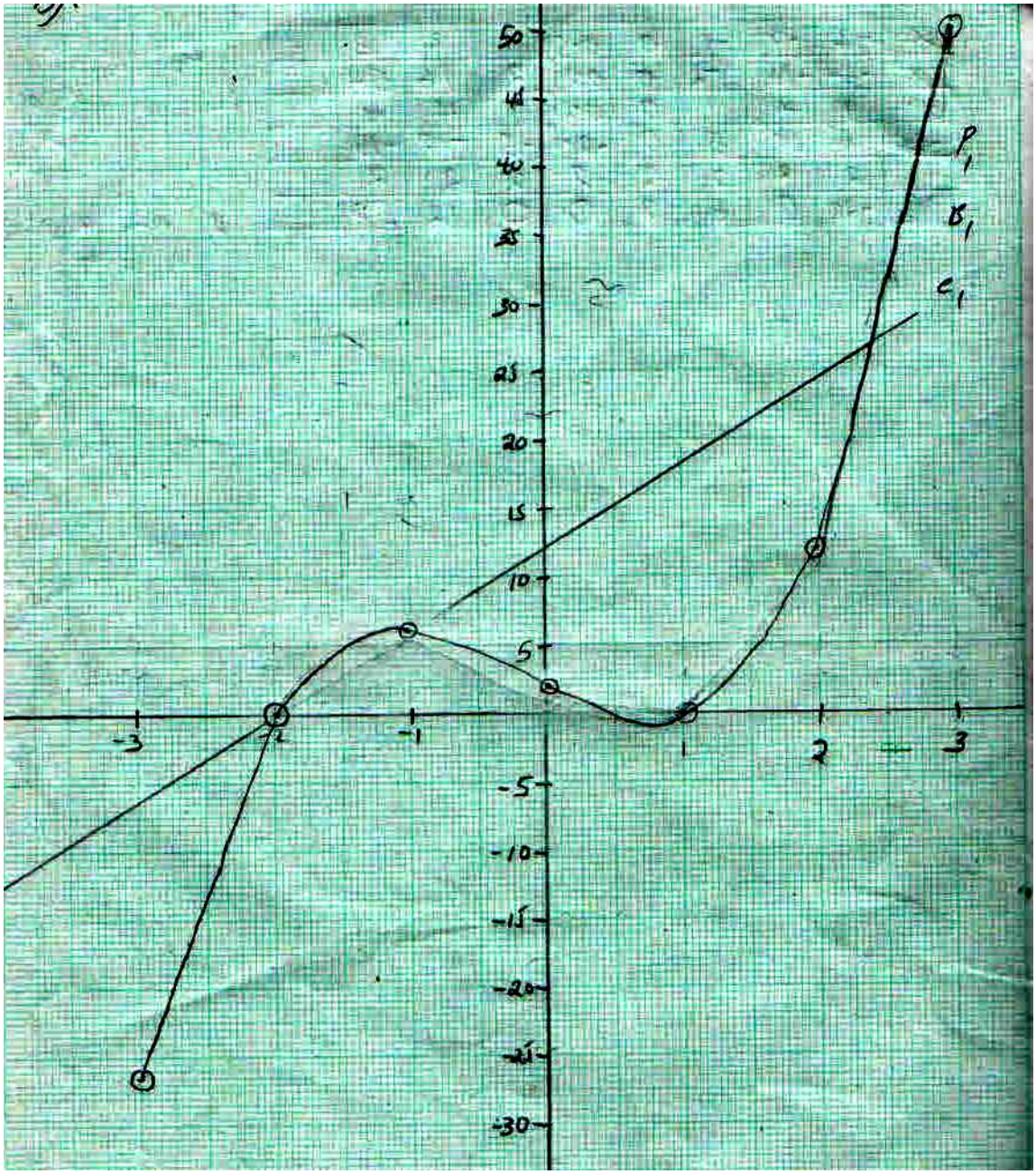
x	-3	-2	-1	0	0.5	1	2	3
$2x^3$	-54	-16	-2	0	0.25	1	16	54
x2	9	4	1	0	0.25	1	4	9
-5x	15	10	5	0	-2.5	-5	-10	
+2	2	2	2	2	2	2	2	2
y	-28	0	6	2	0	0	12	50

B_2 If all values
B1 Any 4 values of y

	(b) 	
	(c) = (-2,0.5,1)±0.1 (d) Line y = 6x + 12 x = -2,-1,2.5±0.1 (e) $\frac{0-2.0}{1.3-2.5}$ = 1.667	B1 For all B1 B1 For all M_1A_1