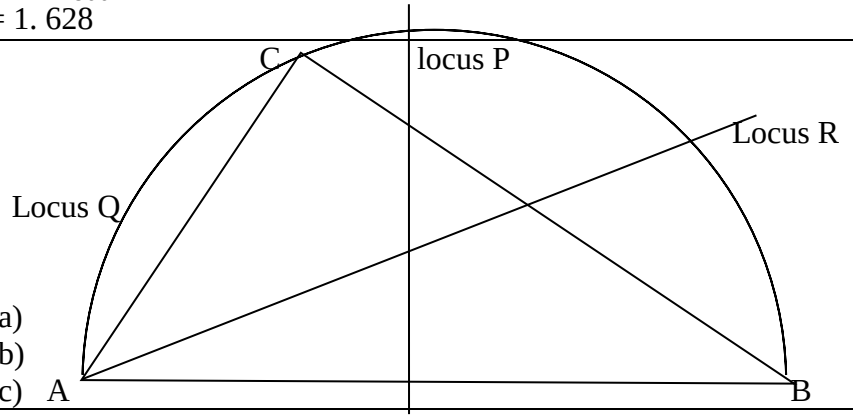
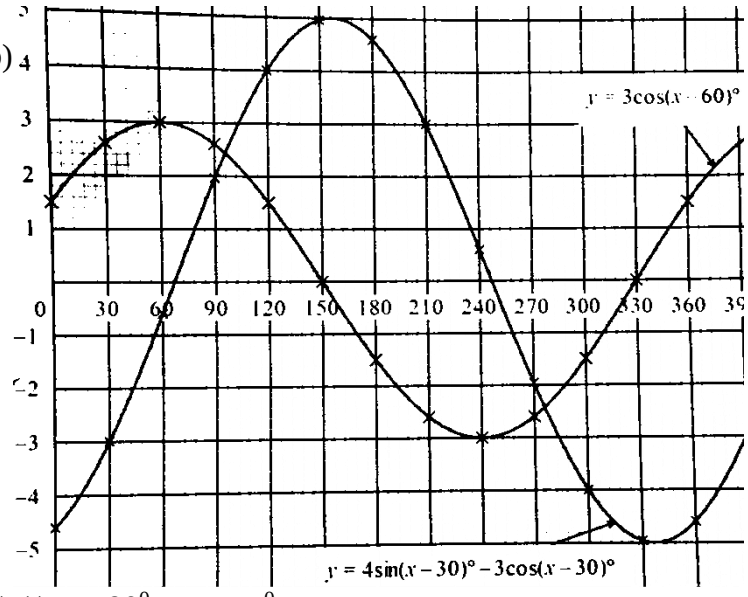
121/2 MATHEMATICS PAPER 2 MARKING SCHEME

NO	WORKING	MK	COMMENT
1.	$\log\left(\frac{x+4}{25}\right) = \log(x-4)$ $\frac{x+4}{25} = x - 4$ $25x - 100 = x + 4$ $25x - x = 4 + 100$ $24x = 104$ $x = 4\frac{1}{3}$	M_1 M_1 A_1	Single logs on both sides Dropping logs $x = 4\frac{1}{3}$
2.	$\frac{3}{\sqrt{5}-2} + \frac{1}{\sqrt{5}} = \frac{3\sqrt{5}+\sqrt{5}-2}{\sqrt{5}(\sqrt{5}-2)} = = \frac{4\sqrt{5}-2}{5-2\sqrt{5}}$ $\frac{4\sqrt{5}-2}{5-2\sqrt{5}} \times \frac{5+2\sqrt{5}}{5+2\sqrt{5}} = \frac{(4\sqrt{5}-2)(5+2\sqrt{5})}{(5-2\sqrt{5})(5+2\sqrt{5})}$ $\frac{20\sqrt{5}+40-10-4\sqrt{5}}{25-20} = \frac{16\sqrt{5}+30}{25-20}$ $\frac{16\sqrt{5}+30}{5}$ $= 6 + \frac{16}{5}\sqrt{5}$	M_1 M_1 A_1	Expression for single fraction Simplified denominator over a rationalized numerator Correct format
3.	(a) $2^6 - 6(2^5)x + 15(2^4)x^2 - 20(2^3)x^3 + ---$ $64 - 192x + 240x^2 - 160x^3 + ---$ (b) $2 - x = 1.99$ $x = 0.01$ $64 - 192(0.01) + 240(0.01)^2 - 160(0.01)x^3 + ---$ 62.10384	B_1 M_1 A_1	Correct expansion up to the 4^{th} term Correct substitution for $x = 0.01$ Allow 62.10 correct to 4sgf
4.	(a) $a^3 = \frac{bx}{b+x}$ $a^3b + a^3x = bx$ $bx - a^3x = a^3b$ $x(b - a^3) = a^3b$ $x = \frac{a^3b}{b - a^3}$ (b) $x = \frac{2^3 \times 6}{6 - 2^3}$ $= -24$	M_1 A_1 B_1	Collecting terms in x x made the subject
5.	$\left(\frac{2}{3} \times \frac{20}{100} \times \frac{3}{10}\right) + \left(\frac{1}{3} \times \frac{10}{100} \times \frac{3}{10}\right)$ $= \frac{120}{3000} + \frac{30}{3000}$ $= \frac{150}{3000}$	B_1 B_1 M_1 A_1	Correct probability for LH boy Correct probability for LH girl Addition of correct probabilities Allow equivalents
6.	R.E $= \frac{0.05}{7.5} + \frac{0.05}{5.2} = \frac{1}{150} + \frac{1}{104}$ PE $= \frac{127}{7800} \times 100$ $= 1.628$	M_1 M_1 A_1	RE PE CAO
7.	 (a) (b) (c)	 B_1 B_1 B_1	 Locus P perpendicular bisector Locus R angle bisector Locus Q semi circle

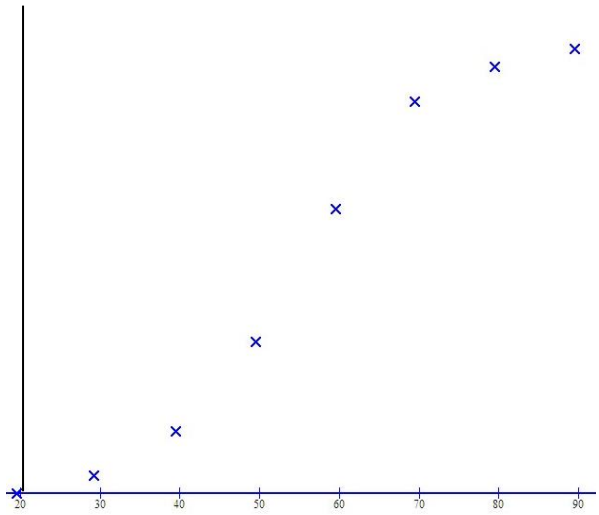
8.	$M(\frac{2+8}{2}, \frac{1+1}{2}) = M(5,1)$ $r = \sqrt{(8-5)^2 + (1-1)^2} = 3$ $(x-5)^2 + (y-1)^2 = 3^2$ $x^2 - 10x + 25 + y^2 - 2y + 1 = 9$ $x^2 + y^2 - 10x - 2y + 17 = 0$	B_1 M_1 A_1	C(5,1) and r =3 seen or used Correct substitution in equation of a circle Equation of a circle in correct format
9.	$-\frac{1}{2}\begin{pmatrix}2\\2\\-4\end{pmatrix} + \frac{3}{2}\begin{pmatrix}6\\10\\2\end{pmatrix}$ $\begin{pmatrix}-1\\-1\\2\end{pmatrix} + \begin{pmatrix}9\\15\\3\end{pmatrix} = \begin{pmatrix}8\\14\\5\end{pmatrix}$ $\overrightarrow{OR} = 8\mathbf{i} + 14\mathbf{j} + 5\mathbf{k}$	 M_1 A_1 B_1	 Column vector $\overrightarrow{OR}$ Unit vector $\overrightarrow{OR}$
10.	Value of the truck after first 2 years $A = P(1-\frac{r}{100})^n$ $= 1,800,000(1-\frac{10}{100})^2$ $= 1,458,000$ Value of the truck for the next 2 years $= 1,458,000(1-\frac{15}{100})^2$ $= 1,053,405$ Value at the end of the 5^{th} year $= 1,053,405(1-\frac{15}{100})^1$ $= 895,394.25$	 M_1 A_1 B_1 B_1	 Correct substitution Value after 2 years Value after 4 years Value at the end of the 5^{th} year
11.	$cp = \frac{(3\times 300)+(2\times 400)}{(3+2)} = \frac{900+800}{5}$ $=340$ s.p $= \frac{125}{100} \times 340$ $= 425$	M_1 M_1 A_1	Expression for cost price Expression for selling price sp = 625
12.	$6(1-\sin^2 x) + 7\sin x - 8 = 0$ $6 - 6\sin^2 x + 7\sin x - 8 = 0$ $-6\sin^2 x + 7\sin x - 2 = 0$ $6\sin^2 x - 7\sin x + 2 = 0$ $6\sin^2 x - 4\sin x - 3\sin x + 2 = 0$ $2\sin x(3\sin x - 2) - 1(3\sin x - 2) = 0$ $(2\sin x - 1)(3\sin x - 2) = 0$ $\sin x = \frac{1}{2}$ or $\sin x = \frac{1}{3}$ $x = 30^0, 150^0, 19.47^0, 160.53^0$	 M_1 A_1 B_1	 Correct attempt to solve quadratic equation For both All correct
13.	ASF = Det_1 x Det_2 = (2 x 5 – 3 x 1) x (3 x 1 – 0 x 1) = 7 x 3 = 21 Original area $= \frac{168}{21}$ $= 8$	M_1 M_1 A_1	Expression for ASF Expression for Original area
14.	a, a + d, a + 3d $r = \frac{3+d}{3} = \frac{3+3d}{3+d}$ $(3 + d)(3 + d) = 3(3 + 3d)$ $9 + 6d + d^2 = 9 + 9d$ $d(d - 3) = 0$ $d = 3$	M_1 M_1 A_1	Expression for r Correct attempt to solve d = 3

15.	New radius = $\frac{4}{3}$ r, New height = $\frac{3}{4}$ h New volume = $\frac{1}{3}\pi(\frac{4}{3}r)^2(\frac{4}{3}r) = \frac{4}{3}(\frac{1}{3}\pi r^2h)$ Old volume = $\frac{1}{3}\pi r^2h$ % Change in volume = $\frac{\frac{4}{3}-1}{1}$ x 100% = $33\frac{1}{3}$ % increase	B_1 B_1	For both, seen or used
16.	(a) 6(XC) = 5 x 4.8 XC= 4 (b) BT^2 = 8 x 18 BT = $\sqrt{144}$ = 12	M_1 A_1 M_1 A_1	Expression Expression
17.	(a) (i) (62,000 + 16,500 + 8,000 + 6,000) – ($\frac{7.5}{100}$ x 62,000) = 92,500 – 4,650 = 87,850 (ii) Tax charges 1st slab = $\frac{10}{100}$ x 24,000 = 2,400 2nd slab = $\frac{15}{100}$ x 8,333 = 1,249.95 3rd slab = $\frac{25}{100}$ x 8,333 = 2,083.25 Remainder = $\frac{30}{100}$ x (87,850-40,666) = 14,155.20 Total Tax charged = 19,888.4 (b) (i) Tax paid = 19,888.4 – 2,400 = 17,488.4 (ii) Total Deductions 17,488.4 + $\frac{2}{100}$ x 62,000 + 4,000 + $\frac{4.25}{100}$ x 62,000 + 5,000 + 22,735 = 53,098.4 (iii) Net pay = Gross pay – deductions = 92,500 - 53,098.4 = 39,401.6	M_1 A_1 M_1 M_1 A_1 B_1 M_1 A_1 B_1	Expression 1st and 2nd slab 3rd slab Addition of tax charged Total tax Tax paid Expression Net pay
18.	(a) (b) (c) (i) x = 90^0, x = 222^0 (ii) 96^0 < x < 276^0		

0	30	60	90	120	150	180	210	240	270	300	330	360
-4.60	-3.00	-0.60	1.96	4.00	4.96	4.60	3.00	0.60	-1.96	-4.00	-4.96	-4.60
1.50	2.60	3.00	2.60	1.50	0.00	-1.50	-2.60	-3.00	-2.60	-1.50	0.00	1.50

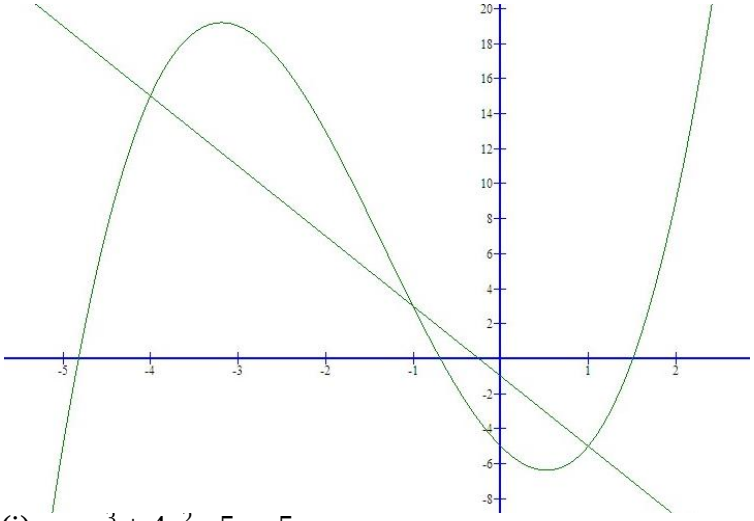


B_1	for $4\sin(x-30) - 3\cos(x-30)$
B_1	for $3\cos(x-60)$
P_1	for $4\sin(x-30) - 3\cos(x-30)$
C_1	smooth continuous curve
P_1	for $3\cos(x-60)$
C_1	smooth continuous curve
B_1	± 2
B_1	± 2
B_1	± 2
B_1	± 2

19.	(a) Fraction of the water in the tank after 2 ½ hours $\frac{1}{20} + \frac{2}{15} = \frac{11}{60}$ $\frac{11}{60}$ x $2\frac{1}{2}$ $= \frac{11}{24}$ (b) $\frac{11}{60} - \frac{1}{10}$ $= \frac{1}{12}$ $\frac{1}{12}$ x 6 $= \frac{1}{2}$ $\frac{11}{24} + \frac{1}{2} = \frac{23}{24}$ $1 - \frac{23}{24} = \frac{1}{24}$ (c) $\frac{2}{15} - \frac{1}{10}$ $= \frac{1}{30}$ $\frac{1}{24}$ x $\frac{30}{1}$ $= \frac{5}{4}$ = 1hr 15 min 0800 0830 0115 + 1745 hours 5.45pm	M_1 M_1 A_1 M_1 M_1 M_1 A_1 M_1 M_1 A_1	Expression for 1 hour Expression for $2\frac{1}{2}$ hours Expression for 3 taps Expression for 6 hours Total part filled Remaining part Expression for B and C Time takes
20.	(a) cf 2 7 17 32 44 48 50  (b) (i) $Q_1 = 45.5$, $Q_3 = 64$ $\frac{64 - 45.5}{2}$ 9.25 (ii) (50-26) + 1 = 25 (iii) Failed $\frac{70}{100}$ x 50 = 35 Pass mark at $36^{th} = 62.5$	B_1 S_1 P_1 C_1 B_1 M_1 A_1 B_1 M_1 A_1	cf Linear/accommodative Accurate Smooth continuous curve Q_1 and $Q_3 = 64$, allow ± 0.1

21.	(a) $\theta = 110 + 70 = 180$ $\frac{180}{360}$ x 2 x 3.142 x 6370cos45 141,152.41696 (b) 60x180cos45 7636.753237nm (c) Central angle = $2\sin^{-1}(\cos 45 \sin 90) = 90$ Distance = 90 x 60 = 5400nm Speed = $\frac{5400\text{nm}}{15\text{hrs}}$ = 360knots (d) longitude difference = $110 + 70 = 180^0$ Time difference = 180 x 4 = 720 min = 12 hrs Local time at B is 9.00am Sunday	M_1 A_1 M_1 A_1 M_1 M_1 A_1	Expression for distance Expression for distance Shortest distance Expression for speed in knots
22.	(a) (b) (c) (i) $y = x^3 + 4x^2 - 5x - 5$ $0 = x^3 + 4x^2 - 5x - 5$ - $y = 0$ x = -4.8 or x = -0.8 or x = 1.5 (ii) $y = x^3 + 4x^2 - 5x - 5$ $-4x - 1 = x^3 + 4x^2 - 5x - 5$ - $y + 4x + 1 = 0$ y = -4x - 1 x = -4 or x = -1 or x = 1	B_2 B_1 S_1 P_1 C_1 L_1 B_1 B_1 L_1 B_1	All correct At least 5 correct Linear/accommodative Accurate plots Smooth continuous curve Line y = 0 labeled Allow ± 0.1 Line y = -4x – 1 drawn/labeled Allow ± 0.1
23.	(a) AO (b) (i) AO = ½ $\sqrt{6^2 + 6^2}$ = 4.243 VA = $\sqrt{10^2 + 4.243^2}$ = 10.86 (ii) Tan $\theta = \frac{10}{4.243}$ $\theta = \text{Tan}^{-1}(\frac{10}{4.243})$ = 67.01 (iii) Tan $\theta = \frac{10}{3}$ $\theta = \text{Tan}^{-1}(\frac{10}{3})$ = 73.30 (iv) 2Tan $\theta = \frac{3}{10}$ $2\theta = 2\text{Tan}^{-1}(\frac{3}{10})$ = 33.40	B_1 B_1 M_1 A_1 M_1 A_1 M_1 A_1 M_1 A_1	Projection of VA on ABCD AO seen/used Expression for VA VA =10.86 Allow equivalents Allow equivalents Allow equivalents

x	-5	-4	-3	-2	-1	0	1	2
y	-5	15	19	13	3	-5	-5	9



24.	(a) a = 4t -12 at t = 0, v = 18 v = $\int(4t-12)dt$ = $\frac{4t^2}{2}$ - 12t + c = $2t^2$ - 12t + c 18 = $2(0)^2$ – 12(0) + c c = 18 v = $2t^2$ - 12t + 18 at rest, v = 0 $2t^2$ - 12t + 18 = 0 t^2 - 6t + 9 = 0 (t-3)(t-3) = 0 t =3seconds (b) s =$\int_0^3(2t^2 - 12t + 18)dt$ $[\frac{2}{3}t^3$ -6t^2 +18t$]_0^3$ $[\frac{2}{3}(3)^3$ - 6$(3)^2$ +18(3)] – $[\frac{2}{3}(0)^3$ - 6$(0)^2$ +18(0)] 18 -0 18m	M_1 M_1 M_1 A_1 M_1 M_1 M_1 M_1 A_1	Correct integral Equation in v Equating v to 0 Correct attempt to solve Correct integral with limits Correct substitution of limits Subtraction