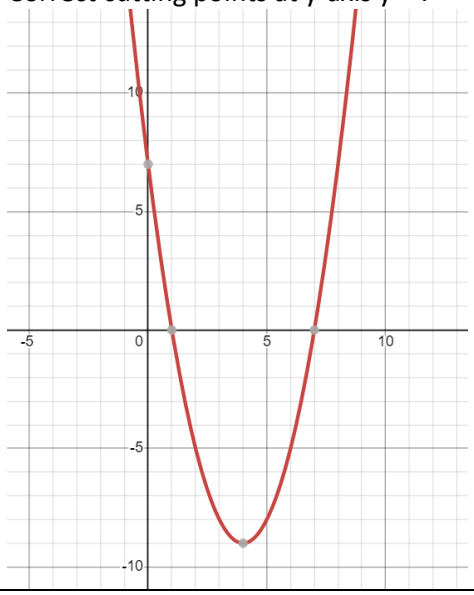
Mark Scheme **Tampines Secondary School**
Mathematics Department

Marking Scheme for 3E Math Preliminary Examination

[√ means follow through] **Total Marks : 90**

No.	Solutions	Mark
1	$A = P(1 + \frac{R}{100})^n$ $A = 4500\ (1 + \frac{2.8}{100})^5$ =5166.28	M1 A1
2	Diagram 4	B1
3	$3 \times 27^n = 1$ or $27^n = \frac{1}{3}$ $3^1 \times 3^{3n} = 3^0$ or $3^{3n} = 3^{-1}$ $3^{3n+1} = 3^0$ n = $-\frac{1}{3}$	M1 A1
4	Listing or any method 8 numbers 13 on the left 14 14 14 14 14 15 …….. 8 numbers 16,17 on the right When x =1 , median is 14 When x =2, …. When x = 4 median is 14 When x = 5, median is 14.5 Range of x is $0 \leq x \leq 4$ or $0 \leq x < 5$.	M1 o.e A1
5a	9, 17	B2
5bi	$\frac{1}{3}$	B1
5bii	$\frac{1}{2}x + \frac{1}{2}y \geq \frac{17}{2}$ ➔ $x + y \geq 17$ $= \frac{1}{12}$	M1 A1 or B2
6a	12	B1
6bi	$\frac{12}{37}$	B1
6bii	$-\frac{35}{37}$	B1

7	$10x + 3y = 124 - - - - - - - - -(1)$ $8x + 5y = 133 - - - - - - - - -(2)$ Any method $(1) \times 5: 50x + 15y = 620 - - - - - - - - -(2)$ $(1) \times 3: 24x + 15y = 399 - - - - - - - - -(2)$ x = normal rate = \$8.5 y = overtime rate = \$13	M1 M1 any method A1 A1
8	Angle PAQ =.angle BAC = angle $\angle SAU = \frac{\pi}{6}$ Area of triangle ABC = $\frac{1}{2}(4x)(4x)sin\frac{\pi}{6} = 4x^2$ Area of sector APRQ/AUTS = $\frac{1}{2}r^2\theta = \frac{1}{2}(8x)(8x)\frac{\pi}{6} = \frac{16\pi}{3}x^2$ Area of triangle ASU / APQ = $\frac{1}{2}(8x)(8x)sin\frac{\pi}{6} = 16x^2$ Area of segment = $(2)\frac{16\pi}{3}x^2 - (2)(16)x^2$ (or at least 1 segment shown) Area of shaded region = $4x^2 + (2)\frac{16\pi}{3}x^2 - (2)16x^2$ = $(\frac{32}{3}\pi - 28)x^2$	M1 M1 M1 M1 M1 A1
9	$(6n+1)^2 - (6n-1)^2 = (6n + 1 - (6n-1))(6n + 1 + 6n - 1)$ = 2(12n) = 24 n Or $36n^2 + 12 + 1 - (36n^2 - 12 + 1)$ = 24n	M1 A1
10	$(n-2) \times 180 = 720$ $3x + 135 + 115 + 164 + 90 = 720$ x = 72	M1 A1

11a	$7 - 8x + x^2 = x^2 - 8x + 7$ $= (x-4)^2 - 16 + 7$ $= (x-4)^2 - 9 = -9 + (x + (-4))^2$	 M1 o.e A1
11b	(4, -9) turning point indicated Correct cutting points at x-axis x = 1, 7 Correct cutting points at y-axis y = 7 	B1 B1 B1
12a	PQ // AC $\angle BPQ = \angle BAC$ (corresponding angles) $\angle BQP = \angle BCA$ (corresponding angles) $\angle PBQ = \angle ABC$ (common angles) Since all corresponding angles of triangle ABC and triangle PBQ are equal, hence triangle ABC is similar to triangle PBQ. (AAA Similarity test or AA similarity test)	 M1 for any 1 correct equal angles shown A1 conclusion with 2nd angle shown
12b	$\frac{Area\ of\ triangle\ ABC}{Area\ \ of\ triangle\ PBQ} = \left(\frac{3}{2}\right)^2 = \frac{9}{4}$ $\frac{Area\ of\ triangle\ ABC}{Area\ \ of\ trapezium\ APQC} = \frac{9}{5}$ or 1.8	M1 A1

13a	Mean = $\frac{\Sigma ft}{\Sigma t} = \frac{25\times35+62\times45+35\times55+22\times65+6\times75}{150} = 49.8$	B1
13b	Standard deviation = $\sqrt{\frac{\Sigma ft^2}{\Sigma t} - mean(\bar{t})^2}$= $\sqrt{\frac{25\times35^2+62\times45^2+35\times55^2+22\times65^2+6\times75^2}{150} - mean(\bar{t})^2}$ =10.565 = 10.6 minutes	B1
13c	His claim is wrong as the standard deviation measures consistency and how close the values are to one another, small standard deviation can mean most runners runs slower too.	B1
14a	$= 4x^2 - 10xq - 10xq + 25q^2$ by expansion or o.e $= 4x^2 - 20qx + 25q^2$	M1 A1 or B2
14b	$4x^2 - 20qx + 25q^2 = 4x^2 + 40x + 100$ $-20q = +40$ $q = -2$ $25q^2 = 100$ $q = 2, q = -2$ Hence $q = -2$	 M2 A1
15	$\left(\frac{3x}{4y^2}\right)^{-2} = \frac{1}{\left(\frac{3x}{4y^2}\right)^2}$ or $\left(\frac{4y^2}{3x}\right)^2$ seen $= \frac{16y^4}{9x^2}$	M1 A1

16a	1 : 65000	B1
16b	1 : 65000 1cm : 0.65 km 32 cm rep 20.8 km 32 cm	 M1 A1
16c	1 : 65000 1cm : 0.65 km Area scale: $1cm^2$: 0.4225 km^2 60 cm^2 : 20.35 km^2 20.35 km^2	 M1 A1
17a	$x = 4$	B1
	$y = 2$	B1
17b	LCM = $2^4 \times 3^3 \times 5 \times 7$	B1
17c	$k = 5$	B1
18a	$12nm - 3n - 4m^2 + m = 3n(4m - 1) - m(4m - 1)$ $= (4m - 1)(3n - m)$	M1 A1
18b	$8x^2 - 26x + 15 = 0$ $(2x - 5)(4x - 3) = 0$ $x = \frac{5}{2}$ *or* 2.5 $x = \frac{3}{4}$ *or* 0.75	 M1 A1 A1

19a	$P = \begin{pmatrix} 4 & 2 & 3 \\ 6 & 0 & 3 \end{pmatrix}$	B1
19b	$R = \begin{pmatrix} 4 & 2 & 3 \\ 6 & 0 & 3 \end{pmatrix}\begin{pmatrix} 12 & 2 \\ 25 & -4 \\ 16 & -3 \end{pmatrix}$ $=\begin{pmatrix} 146 & -9 \\ 120 & 3 \end{pmatrix}$	M1 for 2 values correct for the 2 by 2 matrix.
19c	Store A \$9	B1 B1
19d	$(\$146 - 9)$*0.9+(\$123)*0.95 = \$240.15	M1 A1
20a	$BC^2 = 85^2 + 60^2 - 2(85)(60)cos115$ $BC^2 = 15135.70627$ $BC^2 = 123.0272 = 123\,m$	 M1 A1
20b	$\tan 35 = \frac{TA}{85}$ $TA = 59.517 = 59.5$ $\tan\theta = \frac{TA}{TC} = \frac{59.517}{60}$ $\theta = 44.768 = 44.8°$	M1 M1 A1
20c	Area of triangle *ABC* = $\frac{1}{2}absinc = \frac{1}{2}(85)(60)\sin 115$ $=2311.084857$ or $2550\sin 115$ $=2310$ m² $\frac{1}{2}bh = 2311.084857\ or\ 2550sin115$ $\frac{1}{2}(123.02)h = 2311.084857\ or\ 2550sin115$ h = 37.572 = 37.6	M1 M1 o.e A1

21a	$65 \times \frac{20}{60} + \frac{1}{2} \times \frac{10}{60}(v + 65) = 28.75$ $\frac{65}{3} + \frac{1}{12}(v + 65) = 28.75$ $\frac{1}{12}(v + 65) = \frac{85}{12}$ $v + 65 = 85$ v = 85 – 65 = 20 (shown)	M1 M1 o.e A1
21b	$a = \frac{0-65}{\frac{30}{60}}$ = -130 km/h Deceleration = 130 km/h	M1 or o.e A1
21c	Total distance travelled = $28.75 + 0.5(65)\left(\frac{30}{60}\right) = 45\ km$ Average speed = $\frac{45\ km}{1\ h}$ = 45 km/h	M1 A1
22a	Distance of PR = $\sqrt{(-1-3)^2 + (4-6)^2}$ $= \sqrt{20} = 4.4721.. = 4.47$	M1 A1
22b	$\frac{b-4}{9-(-1)} = \frac{b}{8}$ $\frac{b-4}{10} = \frac{b}{8}$ $8b - 32 = 10b$ $-32 = 2b$ b = – 16 $y = -\frac{16}{8}x + c$ $4 = -2(-1) + c$ 4 = 2+c C = 2 $y = -2x + 2$	M1 M1 A1

22c	$2y = 4x + 4$ $y = 2x + 2$ Line *k* and line PQ are reflection of one another with respect to the *y*-axis.	A1