2023 4N Prelim P2 MS

1a	5.75 (3sf)	B1
1b	8.71×10^{7}	B1
1c	0.0543	B1
1d	$\frac{4x-1}{3}-\frac{3+x}{6}$ $=\frac{2(4x-1)-3-x}{6}$ $=\frac{8x-2-3-x}{6}$ $= =\frac{7x-5}{6}$	M1 A1
2a	$49\div7^{n}=7^{5}$ $7^{2}\div7^{n}=7^{5}$ $7^{2-n}=7^{5}$ $2-n=5$ $n=-3$	M1 (make all same base) A1
2b	$\left(\frac{8}{x^{3}}\right)^{\frac{-1}{3}}=\left(\frac{x^{3}}{8}\right)^{\frac{1}{3}}$ $=\frac{x}{2}$	M1 (make positive index or apply power of -1/3 into brackets A1
3ai	$\cos\angle QPR=\frac{6}{10}=\frac{3}{5}$	B1
3aii	$\sin\angle PRT=\frac{6}{10}=\frac{3}{5}$	B1
3b	Area $=\frac{1}{2}(10)(3)(\frac{3}{5})$ =9 units^2 OR $\frac{1}{2}(3)(6)=9$	B1
4a	$\frac{504-399}{504}\times100\%$ $=20\frac{5}{6}\%$	M1 A1
4b	Balance = 90% of 399 = 359.10 Int = $\frac{359.1(5)(1)}{100}=17.955$	M1 M1

	Extra = $\frac{17.955}{399}\times 100\%$ =4.5%	A1
5ai	$25x^2-1=(5x+1)(5x-1)$	B1
5aii	$4ax-10x+6ay-15y$ $=2x(2a-5)+3y(2a-5)$ $=(2a-5)(2x+3y)$	M1 A1
5b	$\frac{1}{x+1}+\frac{1}{3-x}=1$ $\frac{3-x+x+1}{(x+1)(3-x)}=1$ $4=3x-x^2+3-x$ $4=-x^2+2x+3$ $x^2-2x+1=0$ $0=(x-1)(x-1)$ x = 1	M1 (combine) M1 (obtain quad eqn/ attempt) M1 (solve eqn) A1
6a	$XZ^2=5.2^2=27.04$ $XY^2+YZ^2=4.5^2+2^2=24.25$ Since $XZ^2\neq XY^2+YZ^2$, the converse of Pythagoras' Theorem is not true. The triangle is not right angled triangle.	M1 (working) A1 (conclude stmt)
6b	$\cos\angle XZY=\frac{5.2^2+2^2-4.5^2}{2(5.2)(2)}$ $\angle XZY=\cos^{-1}(0.51875)$ =58.8° (1dp)	M2 A1
7	See graph	[9]
8ai	Vol = $\pi(5)^2(8)-\frac{2}{3}\pi(5)^3$ =367 cm^3 (3sf)	M1 (either formula) A1
8aii	Total area = $\pi(5)^2+2\pi(5)(8)+2\pi(5)^2$ = 487 cm^2	M1, M1 (cylinder & Hemis) A1
8b	Max = 8 x 5 x 1 = 40	B1

9a	$2x+3y=14----(1)$ $4x-y=7----(2)$ $(1)\times 2: 4x+6y=28$ $(2):\quad 4x-y=7$ $7y=21$ $y=3$ $x=2.5$	 M1 A1 A1
9bi	$x^2=(3x+7)(x-2)$ $x^2=3x^2-6x+7x-14$ $0=2x^2+x-14$	M1 M1 A1
9bii	$2x^2+x-14=0$ $x=\dfrac{-1\pm\sqrt{1^2-4(2)(-14)}}{2(2)}$ = 2.41 or -2.91	M1 A1, A1
9biii	Length cannot be negative.	B1
10a	$\text{Electricity}=0.2794(793)=221.5642$ $\text{Gas}=0.2166(70)=15.162$ $\text{Water services}=1.21(36.5)=44.165$ $\text{Waterborne}=0.92(36.5)=33.58$ $\text{conservation tax}=\dfrac{50}{100}(44.165)=22.0825$ $\text{refuse removal}=9$ Total = \$345.5537 After GST = $345.5537\times\dfrac{108}{100}$ =\$373.20 (2dp)	M1 (find water services) M1(electricity or gas) A1

<table>
<tr>
<td>10b</td>
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<tr><td>SP Group (no contract)</td><td>Total for a month = 29.62 x 793
= $234.8866</td><td>Total over 12 mths
=234.8866 x 12 – 50
= 2768.6392</td></tr>
<tr><td>Sembcorp (12 mth)</td><td>Total for a month =
$\frac{100-22.5}{100}(29.61)(793)$
$=181.9757$</td><td>Total over 12 mths
=181.9757 x 12 – 100
= 2083.7084</td></tr>
<tr><td>Senoko (12 mth)</td><td>Total for a month =
$\frac{100-19}{100}(28.98)(793)$
$=186.1472$</td><td>Total over 12 mths
=186.1472 x 12 – 50
= 2183.7664</td></tr>
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Since the cost over 1 year is the cheapest for Sembcorp,

Get the 12 months plan from Sembcorp.
</td>
<td>M1: SPgroup

M1: Sembcorp

M1: Senoko

M1

A1</td>
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<tr><td>11ai</td><td>angle ACD = 90° - 20° = 70° (right angle in semicircle)</td><td>B1</td></tr>
<tr><td>11aii</td><td>Angle AOB = 40° (angle at centre = 2x angle at circumf)</td><td>B1</td></tr>
<tr><td>11aiii</td><td>Angle OBA = (180-40)/2 = 70 (base angles of isos tri)
Angle ABQ = 90-70 =20 (tan perp to rad)</td><td>M1
A1</td></tr>
<tr><td>11bi</td><td>$\frac{YZ}{\sin 70}=\frac{11.5}{\sin 83}$
YZ = 10.8876 = 10.9 m (3sf)</td><td>M1

A1</td></tr>
<tr><td>11bii</td><td>$\tan\theta=\frac{8}{11.5}$
$\theta=34.8$ (1dp)</td><td>M1

A1</td></tr>
<tr><td>12ai</td><td>$\frac{36+38}{2}=37$</td><td>B1</td></tr>
<tr><td>12aii</td><td>$\frac{448}{12}=37\frac{1}{3}$</td><td>B1</td></tr>
<tr><td>12aiii</td><td>7.35 min</td><td>B1</td></tr>
<tr><td>12bi</td><td>47.5 h (also accept 48 h)</td><td>B1</td></tr>
<tr><td>12bii</td><td>52.5 – 38.5 = 14 h or 53 – 38.5 = 14.5 h</td><td>M1, A1</td></tr>
<tr><td>12biii</td><td>>55 h → 100 – 86 = 14
Prob = $\frac{14}{100}\times\frac{13}{99}=\frac{91}{4950}$</td><td>M1, A1</td></tr>
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