Solution to 2023 CCHY Preliminary Examination 4NA Maths 4045/2

S/N	Solution
1(a)	$\dfrac{1.8056}{8.1349+13.8321} = 0.082196021$
1b(i)	0.0822
1b(ii)	0.08
2(a)	$2\ 459\ 457 - 62\ 671 = 2.396786 \times 10^6$ $= 2.40 \times 10^6$ (3sf) #
2(b)	$\dfrac{2459457}{62671} = 39.24394058$ = 40 (nearest 10) #
3(a)	$P(-4,3)$, $Q(2,15)$ gradient $PQ = \dfrac{15-3}{2-(-4)}$ $= 2$ equation of PQ : $y = 2x + c$ At $(-4,3)$, $3 = 2(-4) + c$ $c = 3 + 8$ $= 11$ $\therefore$ equation of PQ is $y = 2x + 11$ #
3(b)	gradient of $CD = 2$ equation of CD : $y = 2x + c$ At $R(7,11)$, $11 = 2(7) + c$ $c = 11 - 14$ $= -3$ $\therefore$ equation of CD is $y = 2x - 3$ #
4(a)	$3x + y = 12$ ——— (1) $x - 2y = 11$ ——— (2) from (1), $y = 12 - 3x$ ——— (3) subst (3) into (2), $x - 2(12 - 3x) = 11$ $x - 24 + 6x = 11$ $7x = 35$ $\div 7$, $x = 5$

	subst $x = 5$ into (3), $y = 12 - 3(5)$ $= -3$ Hence, $x = 5$, $y = -3$ #
4(b)	interior angle $= \dfrac{(8-2)\times 180^\circ}{8}$ $= 135°$ $x° + x° + 135° = 180°$ ($\angle$ sum of Δ) $x° = \dfrac{180^\circ - 135^\circ}{2}$ $= 22.5°$ $\therefore \quad x = 22.5$ #
5(a)	$12m - 3m^3 = 3m(4 - m^2)$ $= 3m(2 + m)(2 - m)$ #
5(b)	$3^{x+6} = 27^x$ $= 3^{3x}$ $x + 6 = 3x$ $6 = 2x$ $\div 2, \quad x = 3$ #
5(c)	$3x^2 + 4x - 9 = 0$ $x = \dfrac{-4 \pm \sqrt{(-4)^2 - 4(3)(-9)}}{2(3)}$ $= \dfrac{-4 \pm \sqrt{124}}{6}$ $x = \dfrac{-4 + \sqrt{124}}{6}$ or $x = \dfrac{-4 - \sqrt{124}}{6}$ $= 1.18925$ $= -2.52259$ $= 1.19$ (2dp) $= -2.52$ (2dp) $\therefore \quad x = -2.52$ or $x = 1.19$ #
6a(i)	$y = k\sqrt{x}$ $54 = k\sqrt{9}$ $= 3k$ $k = \dfrac{54}{3}$ $= 18$ $\therefore \quad y = 18\sqrt{x}$ #
6a(ii)	$72 = 18\sqrt{x}$

$\sqrt{x} = \frac{72}{18}$

$= 4$

$x = 4^2$

$= 16$ #

6(b)

1st pattern	$= 1 \times 3$	$= 2^2 - 1$
2nd pattern	$= 3 \times 5$	$= 4^2 - 1$
3rd pattern	$= 5 \times 7$	$= 6^2 - 1$
4th pattern	$= 7 \times 9$	$= 8^2 - 1$

Pattern for

1st no. of 2nd column	2nd no. of 2nd column	1st no. of 3rd column
$1 \times 2 - 1 = 1$	$1 + 2 = 3$	$\frac{1+3}{2} = 2, 2^2$
$2 \times 2 - 1 = 3$	$3 + 2 = 5$	$\frac{3+5}{2} = 4, 4^2$
$3 \times 2 - 1 = 5$	$5 + 2 = 7$	$\frac{5+7}{2} = 6, 6^2$
$4 \times 2 - 1 = 7$	$7 + 2 = 9$	$\frac{7+9}{2} = 8, 8^2$

$(2n - 1) \times (2n - 1 + 2) = (2n - 1)(2n + 1)$

$\frac{2n-1+2n+1}{2} = 2n$

$\therefore$ the n^{th} pattern

$= (2n - 1)(2n + 1) = 4n^2 - 1$ #

7(a)

$x° = 42°$ (alt $\angle$s, AB // CD)

$\therefore \ x = 42$ #

Method 1

$65° + \angle AFE + 42° = 180°$ (int $\angle$s, AB // CD)

$\angle AFE = 180° - 65° - 42°$

$= 73°$

$y° = \angle AFE$ (vert opp $\angle$s)

$= 73°$ #

$\therefore \ y = 73$

Method 2 to find y

$65° + \angle AFE + 42° = 180°$ (int $\angle$s, AB // CD)

$\angle AFE = 180° - 65° - 42°$

$= 73°$

$73° + \angle EFH = 180°$ (adj $\angle$s on a st line)

$\angle EFH = 180° - 73°$

$= 107°$

$y° + 107° = 180°$ (adj $\angle$s on a st line)

$y° = 180° - 107°$

$= 73°$

$\therefore \quad y = 73$

7(b)

Price after 1st year	Price after 2nd year
90% x \$168000 $= \frac{90}{100}$ x \$168000 = \$151200	90% x \$151200 $= \frac{90}{100}$ x \$151200 = \$136080

price decrease = \$(168000 – 136080)

= \$31920

percentage decrease = $\frac{31920}{168000}$ x 100%

= 19% #

8(a)

1 cm ——— 25000 cm

= 0.25 km

10 cm^2 ——— 10 x 1 cm x 1 cm

= 10 x 0.25 km x 0.25 km

= 0.625 km^2

$\therefore$ the actual area is 0.625 km^2 #

8(b)

volume of fuel per second :

$\pi r^2 h = \pi \times \left(\frac{8\,cm}{2}\right)^2 \times (2 \times 100\ cm)$

$= 3200\pi\ cm^3$

Total volume of fuel = $3200\pi\ cm^3 \times 24 \times 60$

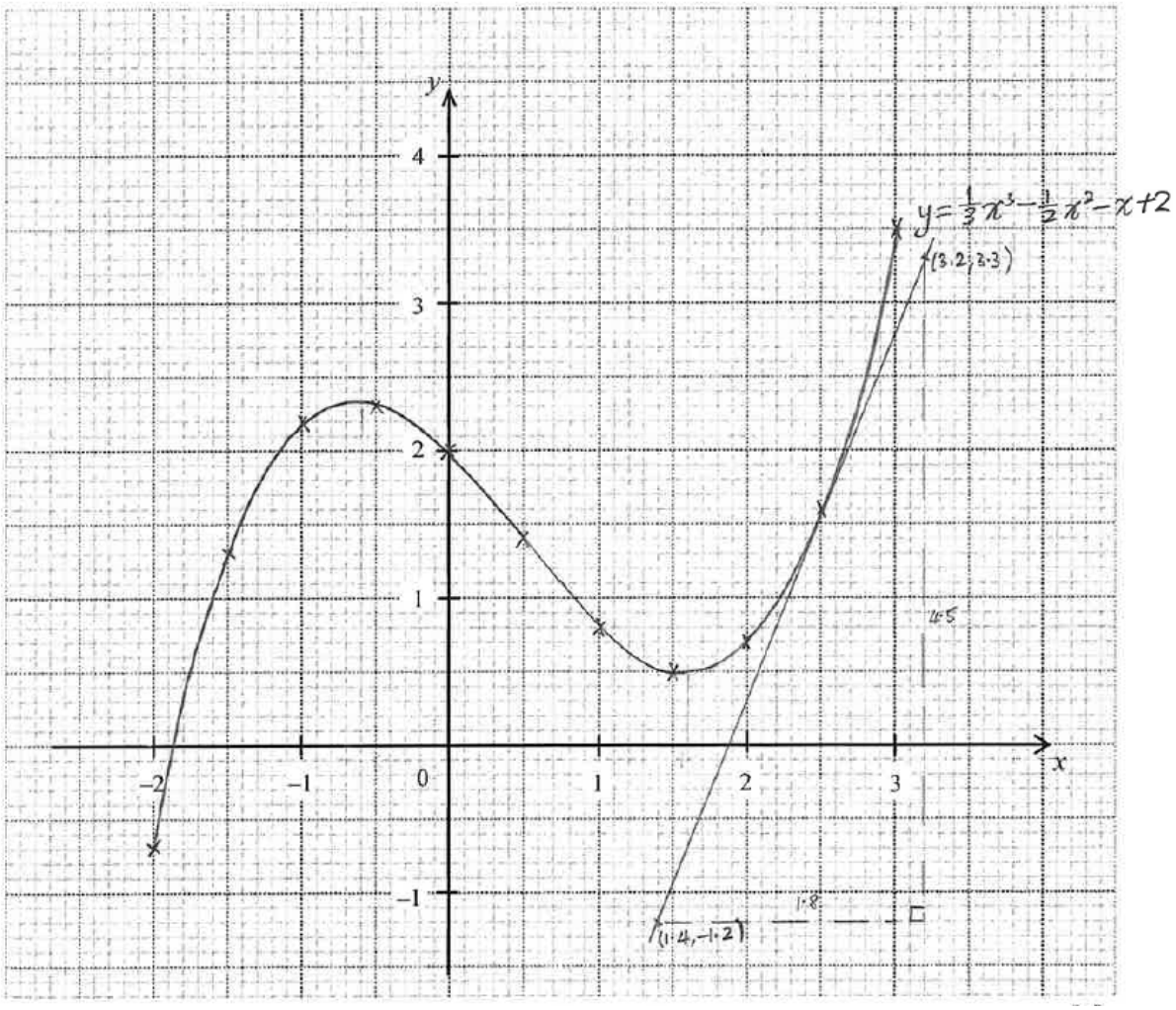
$= 4608000\ \pi\ cm^3$

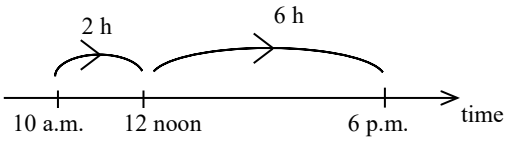
$= 4608\pi$ litres

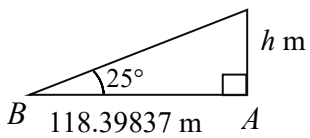
= 14476.45895 litres

= 14476 litres (nearest litres) #

9(a)	2.3 1.4
9(b)	P1 : plot the points correctly C1 : join the points to show a cubic curve C1 : smooth curve
9(c)	draw tangent line gradient = $\frac{4.5}{1.8}$ = 2.5 acceptable range : 2.14 to 2.75



9(d)	$y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - x + 2$ ——— (1) $2x^3 + 12 = 3x^2 + 6x$ ÷6, $\frac{1}{3}x^3 + 2 = \frac{1}{2}x^2 + x$ $\frac{1}{3}x^3 - \frac{1}{2}x^2 - x + 2 = 0$ ——— (2) subst (1) into (2), $y = 0$ $2x^3 + 12 = 3x^2 + 6x$ and $\frac{1}{3}x^3 - \frac{1}{2}x^2 - x + 2 = 0$ are equivalent equations. The graph of $y = \frac{1}{3}x^3 - \frac{1}{2}x^2 - x + 2$ **cuts the *x*-axis at only 1 point**, hence, the equation $2x^3 + 12 = 3x^2 + 6x$ has only **1 solution**.
10a(i)	 number of working hours per day = (2 + 6 – 1) h = 7 h number of days working in a month = 4 x 2 days = 8 days monthly salary = 8 x 7 x \$11 = \$616 #
10a(ii)	20% of \$(616 + 1600) = $\frac{20}{100} \times \$2\,216$ = \$443.20 = \$443 (nearest dollar) ∴ Amy's monthly contribution to CPF is \$443 #
10(b)	take home pay = \$(1600 + 616) – \$443.20 = \$1772.80 savings per month = \$(1772.80 – 10 – 54 – 400) = \$1308.80 savings for 4 months = 4 x \$1308.80 = \$5235.20 savings of \$5235.20 > \$3086.50, hence Amy is correct.

	Yes because her **savings from the 4 months is more than the course fees**.
11a(i)	$\angle EBD = \angle EAD$ (∠s in the same segment) $= 59°$ $\angle AED + 50° + 59° = 180°$ (∠s in opp segment) $\angle AED = 180° - 50° - 59°$ $= 71°$ #
11a(ii)	Method 1 In ΔBCD, $87° + \angle BCD = 50° + 59°$ (ext ∠ of Δ) $\angle BCD = 50° + 59° - 87°$ $= 22°$ #
	Method 2 $50° + 59° + \angle DBC = 180°$ (adj ∠s on a st line) $\angle DBC = 180° - 50° - 59°$ $= 71°$ In ΔBCD, $87° + 71° + \angle BCD = 180°$ (∠ sum of Δ) $\angle BCD = 180° - 87° - 71°$ $= 22°$
11b(i)	$\angle BAC = 180° - 33.1° - 51.4°$ $= 95.5°$ Using Sine Rule, $\frac{AB}{\sin 51.4^\circ} = \frac{150.8}{\sin 95.5^\circ}$ $AB = \frac{150.8 \sin 51.4^\circ}{\sin 95.5^\circ}$ $= 118.39837$ $= 118$ (3sf) $\therefore \quad AB = 118$ m #
11b(ii)	 $\tan 25° = \frac{h}{118.39837}$ $h = 118.39837 \tan 25°$ $= 55.21007$ $= 55$ (nearest whole number) $\therefore$ height of building is 55 m #

12a(i)	$\frac{5}{8}$ $\frac{8}{11}, \frac{8}{11}, \frac{3}{11}$
12a(ii)	P(same gender) = P(both male) + P(both female) $= \frac{3}{8} \times \frac{8}{11} + \frac{5}{8} \times \frac{3}{11}$ $= \frac{39}{88}$ #
12b(i)	24.5 23
12b(ii)	Students in class ***A*** take **longer time** than class ***B*** to complete the problem since **median** of class *A* (24.5 min) is **greater than** the median of class *B* (23 min). Interquartile range : Class *A* : (27 – 16) min = 11 min Class *B* (32.5 – 17.5) min = 15 min The **spread** of time taken is **lesser** in class ***A*** (11 min) compared to class ***B*** (15 min) as the **interquartile range** in class *A* is **smaller** than that in class *B*. Or The **time** taken by students in class ***A*** are **more consistent** than that in class *B* because the **interquartile range** for class *A* (11 min) is **less than** that for class *B* (15 min). Or Students in class ***A*** takes a **shorter time** to complete the problem than students in class ***B*** since **75%** of them completed in **27 min** in class *A* compared to **32.5 min** in class *B*. Or Students in class ***A*** takes **shorter time** to complete the problem than class ***B*** since the longest time taken by students in class *A* is **35 min** while that for class *B* is **42.5 min**