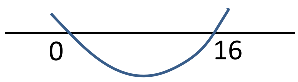
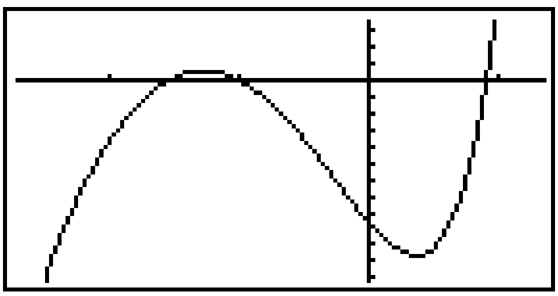
Qn	Solution
1	$2x^2+(k+4)x+(3k+2)=0$ Discriminant: $(k+4)^2-4(2)(3k+2)>0$ $k^2-16k>0$ $k(k-16)>0$  Set of values of k = $\{k \in \Re : k<0 \text{ or } k>16\}$
2	Let $u=e^x$ $7u=34+\frac{5}{u}$ $7u^2-34u-5=0$ $(7u+1)(u-5)=0$ $u=-\frac{1}{7}$ or $u=5$ (*reject*) $\therefore e^x=5$ $x=\ln 5$
3 (i)	 Max pt: $(-1.27, 0.547)$ Min pt $(0.363, -10.6)$ x intercept: $(-1.53, 0)$, $(-1, 0)$, $(0.904, 0)$ y intercept: $(0, -8.61)$
3(ii)	$e^{2x+2}<(3x+4)^2$ $\Leftrightarrow e^{2x+2}-(3x+4)^2<0$ From graph, $x<-1.53$ or $-1<x<0.904$
3(iii)	$\frac{dy}{dx}=2e^{2x+2}-2(3x+4)(3)$ $=2e^{2x+2}-6(3x+4)$

Qn	Solution
	When $x=-1,\ y=0,\ \dfrac{\mathrm{d}y}{\mathrm{d}x}=2-6=-4$ Eqn of tangent: $\dfrac{y-0}{x+1}=-4$ $\therefore y=-4x-4$
3(iv)	From GC: A(0.716, −6.863)
4(ai)	$\dfrac{\mathrm{d}}{\mathrm{d}x}\left(\ln(5x^2-10)\right)=\dfrac{10x}{5x^2-10}$ $=\dfrac{2x}{x^2-2}$
4(ii)	$\dfrac{\mathrm{d}}{\mathrm{d}x}\left(\dfrac{2}{(3x-1)^3}\right)=\dfrac{\mathrm{d}}{\mathrm{d}x}\left(2(3x-1)^{-3}\right)$ $=2(3x-1)^{-4}(-3)(3)$ $=\dfrac{-18}{(3x-1)^4}$
4(b)	$\displaystyle\int\left(2-\frac{1}{\sqrt{x+3}}\right)^2 dx=\int(4-\frac{4}{\sqrt{x+3}}+\frac{1}{x+3})dx$ $=4x-4(2)\sqrt{x+3}+\ln\lvert x+3\rvert+C$ $=4x-8\sqrt{x+3}+\ln\lvert x+3\rvert+C$
5(i)	$x^2+4xy=48$ $y=\dfrac{48-x^2}{4x}$ $V=x^2y$ $=x^2\left(\dfrac{48-x^2}{4x}\right)$ $=\dfrac{x(48-x^2)}{4}$ $=12x-\dfrac{x^3}{4}$

<table>
<tr><th>Qn</th><th>Solution</th></tr>
<tr><td>5(ii)</td><td>

$\frac{\mathrm{d}V}{\mathrm{d}x}=12-\frac{3x^2}{4}$

For stationary value,

$\frac{\mathrm{d}V}{\mathrm{d}x}=0$

$\frac{3x^2}{4}=12$

$x^2=16$

$x=-4$ or $x=4$

$(\textit{reject})$

To verify Max :

<table>
<tr><td>x</td><td>4^-</td><td>4</td><td>4^+</td></tr>
<tr><td>dV/dx</td><td>+</td><td>0</td><td>-</td></tr>
<tr><td>Slope</td><td></td><td></td><td></td></tr>
</table>

V is max when x=4cm

Max $V=32\text{cm}^3$

</td></tr>
<tr><td>6(i)</td><td>

$-2x^2+px+1=(4-p)x+1$

$-2x^2+2px-4x=0$

$2x(-x+p-2)=0$

$x=0$ or $x=p-2$

</td></tr>
<tr><td>6(ii)</td><td>

Area

$=\int_0^{p-2}-2x^2+px+1-[(4-p)x+1]dx$

$=\int_0^{p-2}(2p-4)x-2x^2dx$

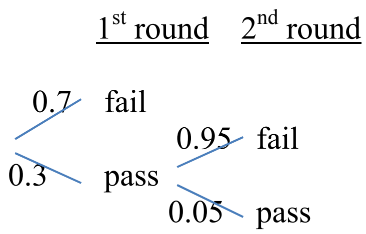
$=\left[(p-2)x^2-\frac{2x^3}{3}\right]_0^{p-2}$

$=(p-2)^3-\frac{2(p-2)^3}{3}$

$=\frac{(p-2)^3}{3}\text{units}^2$

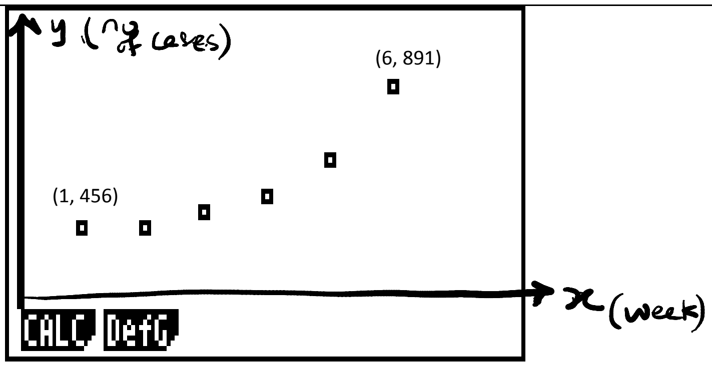
</td></tr>
</table>

<table>
<tr><th>Qn</th><th>Solution</th></tr>
<tr><td>7(i)</td><td>Advantage: It is easy to conduct and time saving.
Disadvantage: The JC2 students may not have a common break time and the sample selected may not be representative of the entire JC2 cohort.</td></tr>
<tr><td>7(ii)</td><td>The student council can divide the students into their respective houses and randomly select the required number from each stratum according to the table below.

<table>
<tr><th>Seletar house</th><th>Rodney house</th><th>Admiralty house</th><th>Canberra house</th></tr>
<tr><td>$\frac{150}{700}\times 60$
≈ 13</td><td>$\frac{160}{700}\times 60$
≈ 14</td><td>$\frac{200}{700}\times 60$
≈ 17</td><td>$\frac{190}{700}\times 60$
≈ 16</td></tr>
</table></td></tr>
<tr><td>8(i)</td><td>
</td></tr>
<tr><td>8(ii)</td><td>Required probability =(0.3)(0.95) + 0.7
= 0.985</td></tr>
<tr><td>8(iii)</td><td>P(fail in second round |fail to get into GEP)
$=\frac{\text{P(fail in 2nd round)}}{\text{P(fail to get into GEP)}}$
$=\frac{0.3\times 0.95}{(0.3\times 0.95)+0.7}$
$=\frac{0.285}{0.985}$
$=\frac{57}{197}=0.289$</td></tr>
<tr><td>8(iv)</td><td>Required probability = $(0.985)^2(0.015)(3)=0.0437$</td></tr>
</table>

Qn	Solution
9(ai)	Let X be the no of delays out of 25 train services during the peak hours. $X \sim B(25, 0.11)$ $P(X < 3) = P(X \le 2) = 0.47087063 = 0.471$
9(ii)	$P(2 < X < 9) = P(X \le 8) - P(X \le 2)$ $= 0.99907689 - 0.47087063$ $=0.528$ **A1**: CAO.
	The delay of a train is independent of the delay of another train. The probability of each train service being delayed is the same.
9(b)	Let Y be the no of days 'good days', out of 7 days. $Y \sim B(7, 0.47087063)$ $P(Y \ge 4) = 1 - P(Y \le 3)$ $= 1 - 0.56350466$ $= 0.436$
9(c)	Let W be the no. of delays out of 70 train services $W \sim B(70, 0.08)$ Since $n = 70$ is large $np = 70(0.08) = 5.6 > 5$ $nq = 70(0.92) = 64.4 > 5$ $\therefore W \sim N(5.6, 5.152)$ approx $P(W < 8) \to P(W < 7.5)$(using continuity correction) $= 0.799$
10(a)	Let X be the mass of a durian in kg. $X \sim N(2.85, \sigma^2)$ $P(X > 3.5) = 0.2$ $P(X \le 3.5) = 0.8$ $P(Z \le \frac{3.5 - 2.85}{\sigma}) = 0.8$ $\frac{0.65}{\sigma} = 0.84162123$ $\sigma = 0.772$
10(bi)	Let G be the weight of a mangosteen in kg. Let M be the weight of a mango in kg. $G \sim N(0.09, 0.02^2)$ $M \sim N(0.40, 0.04^2)$ Let $T = G_1 + G_2 + G_3 + \ldots + G_{10} - (M_1 + M_2)$ $T \sim N(0.1, 0.0072)$ $P(T > 0) = 0.88070 \approx 0.881$

Qn	Solution
10(ii)	Let C be the cost of 2 bags of mangosteens and 2 mangoes. $C \sim N(3(20)(0.09)+5(2)(0.4), 3^2(20)(0.02)^2+5^2(0.04)^2(2))$ $C \sim N(9.40, 0.152)$ $P(C \leq 10) = 0.938$
10(c)	Let W be the mass (kg) of a packet of jam. $\overline{W} = \dfrac{W_1 + W_2 ... + W_{60}}{60}$ Let $\overline{W} \sim N(0.5, \dfrac{0.09^2}{60})$ approx by CLT $P(\overline{W} > 0.52) = 0.0426$
11(i)	Unbiased estimate for $\mu = \overline{x} = \dfrac{1578}{60} = 26.3$ Unbiased estimate for $\sigma^2 = s^2 = \dfrac{1}{59}\left(123.2\right) = 2.088135593 = \dfrac{616}{295} = 2.09$
11(ii)	$H_0 : \mu = 26$ $H_1 : \mu > 26$ Under $\text{H}_0, Z = \dfrac{\overline{X} - \mu}{s / \sqrt{n}} \sim N(0,1)$ approx by CLT μ=26, $\overline{x} = 26.3, s^2 = 2.088136, n = 60$ From GC, p value=0.0539>0.05 Do not reject H_0. There is insufficient evidence at 5% level of significance to conclude that the company has overrated the product.
11(iii)	No. Since n is 60 is large, we can use Central Limit Theorem to have $\overline{X}$ to be approximately normally distributed

Qn	**Solution**
11	$H_0 : \mu = 10$ $H_1 : \mu \neq 10$ Under $\text{H}_0, Z = \dfrac{\overline{X} - \mu}{\sigma / \sqrt{n}} \sim N(0,1)$ μ=10, $\sigma = 0.5$, $n = 25$ Critical region : $z < -1.959964$ or $z > 1.959964$ Since H_0 is not rejected, $-1.959964 < \dfrac{\overline{X} - 10}{0.5 / \sqrt{25}} < 1.959964$ $9.8040036 < \overline{X} < 10.1959964$ $9.80 < \overline{X} < 10.2$
12(i)	The point seems unreasonable because the data was extracted before the week ends. There may be more reported cases towards the end of the week.
12(ii)	
12(iii)	$r = 0.911$ The value indicates that there is strong positive linear correlation between the number of reported dengue cases and time. The number of cases increases when time increases
12(iv)	$y = 81.8857142x + 303.06666$ $y = 81.9x + 303$ (3 sig. fig) When $x = 7, y = 81.8857142(7) + 303.06666$ $= 876.266$ ≈ 876 The estimate is unreliable because $x = 7$ falls outside the data range / the estimate is obtained by extrapolation.