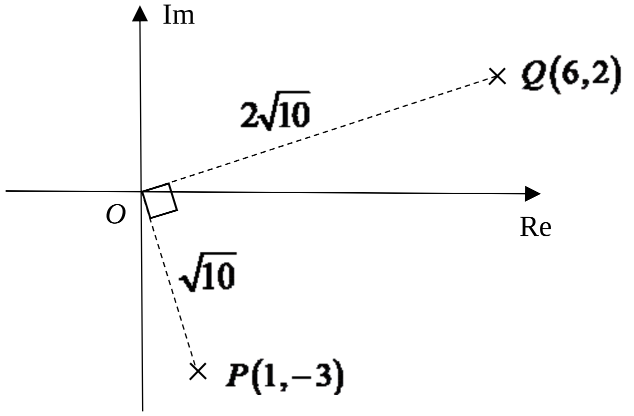
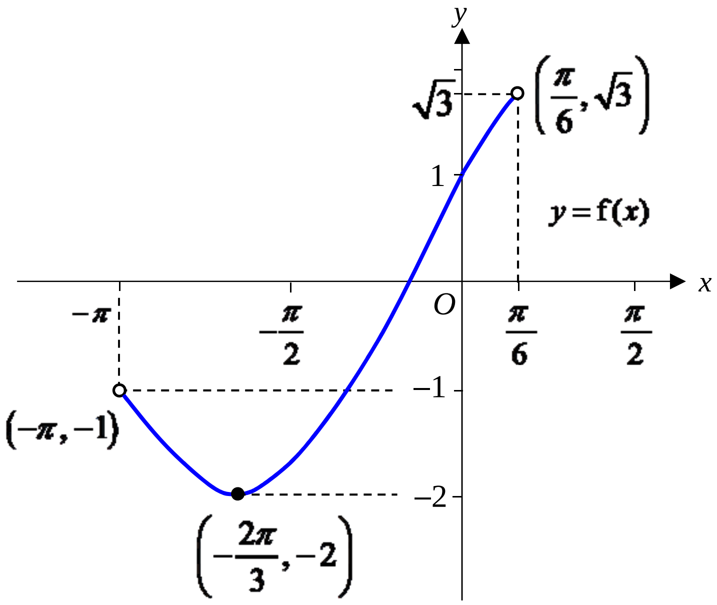
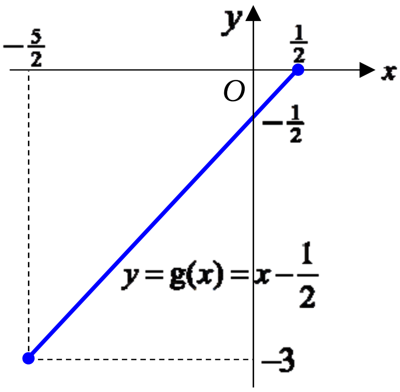
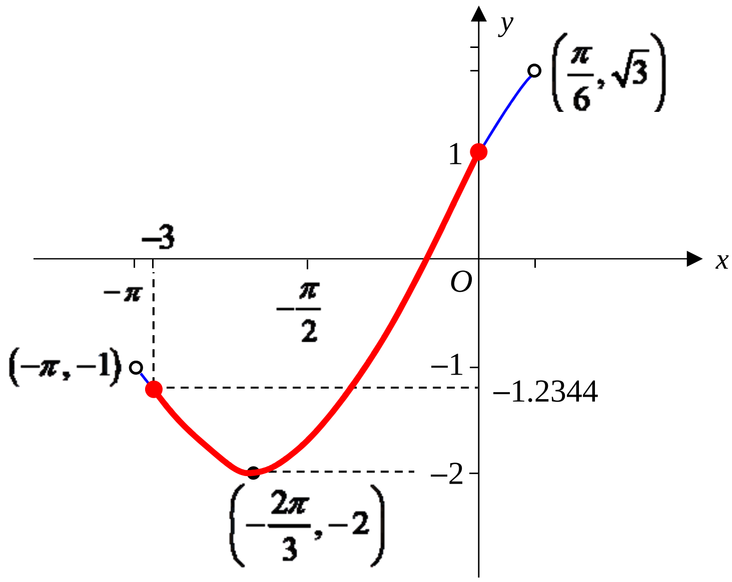
2017 Prelim Paper 2 Comments for Students

Section A

s/n	Solution
1 (i)	$S_1 = b - \frac{3a}{2!} = b - \frac{3a}{2} = k \quad \ldots(1)$ $S_2 = b - \frac{3a}{3!} = b - \frac{a}{2} = k + \frac{2}{3}k = \frac{5}{3}k \quad \ldots(2)$ (2) – (1), $-\frac{a}{2} - \left(-\frac{3a}{2}\right) = \frac{5}{3}k - k$ $\therefore \quad a = \frac{2}{3}k$ $\therefore \; b = k + \frac{3a}{2} = k + \frac{3}{2}\left(\frac{2}{3}k\right) = 2k$
1 (ii)	$S_n = 2k - \frac{2k}{(n+1)!}$ $u_n = S_n - S_{n-1}$ $= \left(2k - \frac{2k}{(n+1)!}\right) - \left(2k - \frac{2k}{n!}\right)$ $= \frac{2k}{n!} - \frac{2k}{(n+1)!}$ $= \frac{2k}{n!}\left(1 - \frac{1}{n+1}\right)$ $= \frac{2k}{n!}\left(\frac{n}{n+1}\right)$ $= \frac{2kn}{(n+1)!}$
1 (iii)	$\sum_{r=1}^{n} u_r = S_n = 2k - \frac{2k}{(n+1)!}$ As $n \to \infty$, $\frac{1}{(n+1)!} \to 0$. $\therefore \; S_n = 2k - \frac{2k}{(n+1)!} \to 2k$ Hence the series $\sum_{r=1}^{\infty} u_r$ converges.

s/n	Solution
2 (i)	$2z+3w=20 \quad ...(1)$ $w-zw^*=6+22\text{i} \quad ...(2)$ From (1), $z=\dfrac{20-3w}{2}$ Substitute into (2), $w-\left(\dfrac{20-3w}{2}\right)w^*=6+22\text{i}$ $2w-(20-3w)w^*=12+44\text{i}$ $2w-20w^*+3ww^*=12+44\text{i}$ Let $w=a+b\text{i}$ $2(a+b\text{i})-20(a-b\text{i})+3(a+b\text{i})(a-b\text{i})=12+44\text{i}$ $2a+2b\text{i}-20a+20b\text{i}+3(a^2+b^2)=12+44\text{i}$ $(3a^2-18a+3b^2)+(22b)\text{i}=12+44\text{i}$ Comparing real and imaginary parts, $22b=44$ $\therefore\ b=2$ $3a^2-18a+3(2)^2=12$ $3a^2-18a+12=12$ $3a(a-6)=0$ $a=0$ (rejected since $a\neq 0$), $a=6$ $\therefore w=6+2\text{i}$ $z=\dfrac{20-3(6+2\text{i})}{2}$ $z=1-3\text{i}$
2 (ii)	Let P and Q represent the complex numbers z and w respectively 

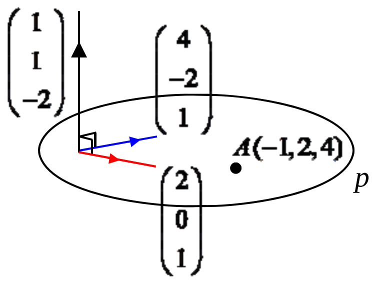
s/n	Solution
3 (i)	$\mathrm{f}(x)=\sqrt{3}\sin x+\cos x$ $R\sin(x+\alpha)=R\sin x\cos\alpha+R\cos x\sin\alpha$ $R\cos\alpha=\sqrt{3}\quad\ldots(1)$ $R\sin\alpha=1\quad\ldots(2)$ $(1)^2+(2)^2$, $\therefore\ R=\sqrt{(\sqrt{3})^2+1^2}=2$ (1) / (2), $\tan\alpha=\frac{1}{\sqrt{3}}$, $\therefore\ \alpha=\frac{\pi}{6}$ Hence $\mathrm{f}(x)=2\sin\left(x+\frac{\pi}{6}\right)$
3 (ii)	 When $y=-2$, $2\sin(x+\frac{\pi}{6})=-2$ $\sin(x+\frac{\pi}{6})=-1$ $x+\frac{\pi}{6}=-\frac{\pi}{2}\Rightarrow x=-\frac{2\pi}{3}$ $\therefore$ turning point is $\left(-\frac{2\pi}{3},-2\right)$. $R_{\mathrm{f}}=[-2,\sqrt{3})$

s/n	Solution
3 (iii)	Since $-\frac{5}{2} \le x \le \frac{1}{2}$, $g(x) = \frac{1}{2} + x - 1 = x - \frac{1}{2}$ $R_g = [-3, 0]$ $D_f = (-\pi, \frac{\pi}{6})$ Since $R_g \subset D_f$, fg exists.   $\overbrace{[-\frac{5}{2}, \frac{1}{2}]}^{D_g} \rightarrow \overbrace{[-3, 0]}^{R_g = \text{restricted } D_f} \rightarrow \overbrace{[-2, 1]}^{\text{restricted } R_f = R_{fg}}$ $\therefore\ R_{fg} = [-2, 1]$
3 (iv)	From the graph, largest domain for f $= [-\frac{2\pi}{3}, \frac{\pi}{6})$ Let $y = 2\sin(x + \frac{\pi}{6})$ $x = \sin^{-1}\left(\frac{y}{2}\right) - \frac{\pi}{6}$ $f^{-1} : x \mapsto \sin^{-1}\left(\frac{x}{2}\right) - \frac{\pi}{6}$, $x \in \mathbb{R}$, $-2 \le x < \sqrt{3}$.

<table>
<tr><th>s/n</th><th>Solution</th></tr>
<tr><td>4
(i)</td><td>

$\begin{pmatrix}4\\-2\\1\end{pmatrix}\times\begin{pmatrix}2\\0\\1\end{pmatrix}=\begin{pmatrix}-2\\-2\\4\end{pmatrix}=-2\begin{pmatrix}1\\1\\-2\end{pmatrix}$

$\underset{\sim}{r}\cdot\begin{pmatrix}1\\1\\-2\end{pmatrix}=\begin{pmatrix}-1\\2\\4\end{pmatrix}\cdot\begin{pmatrix}1\\1\\-2\end{pmatrix}=-7$



$\therefore$ Cartesian equation of p is $x+y-2z=-7$.

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<tr><td>4
(ii)</td><td>

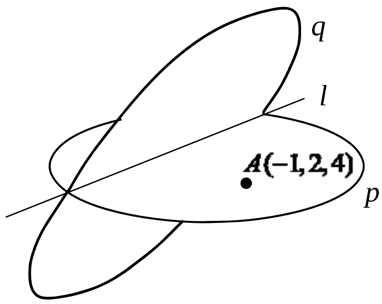
$x+y-2z=-7$

$x-2y+z=2$

Using GC,

a vector equation of l is

$\underset{\sim}{r}=\begin{pmatrix}-4\\-3\\0\end{pmatrix}+\alpha\begin{pmatrix}1\\1\\1\end{pmatrix},\alpha\in\mathbb{R}$.



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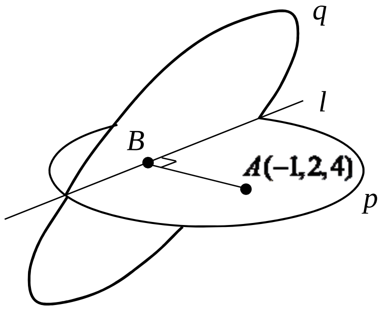
<tr><td>4
(iii)</td><td>

$\overrightarrow{OB}=\begin{pmatrix}-4+\alpha\\-3+\alpha\\\alpha\end{pmatrix}$

$\overrightarrow{AB}=\begin{pmatrix}-4+\alpha\\-3+\alpha\\\alpha\end{pmatrix}-\begin{pmatrix}-1\\2\\4\end{pmatrix}$

$=\begin{pmatrix}\alpha-3\\\alpha-5\\\alpha-4\end{pmatrix}$



$\begin{pmatrix}\alpha-3\\\alpha-5\\\alpha-4\end{pmatrix}\cdot\begin{pmatrix}1\\1\\1\end{pmatrix}=0$

$\alpha-3+\alpha-5+\alpha-4=0 \quad\Rightarrow\quad \alpha=4$

$\therefore\ \overrightarrow{OB}=\begin{pmatrix}0\\1\\4\end{pmatrix}=\underset{\sim}{j}+4\underset{\sim}{k}$

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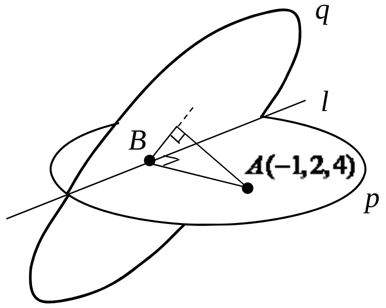
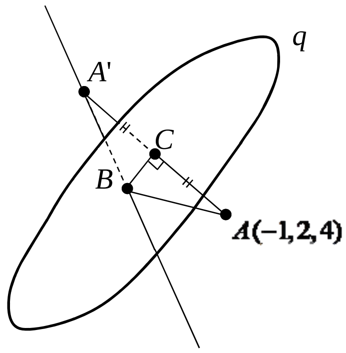
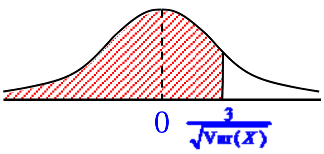
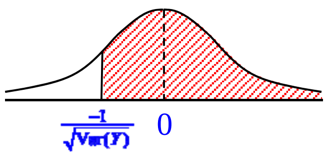
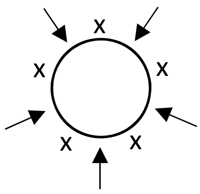
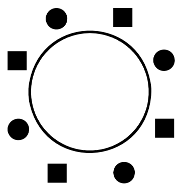
s/n	Solution
4 (iv)	Equation of q: $\underset{\sim}{r}\cdot\begin{pmatrix}1\\-2\\1\end{pmatrix}=2$ $\overrightarrow{AB}=\begin{pmatrix}4-3\\4-5\\4-4\end{pmatrix}=\begin{pmatrix}1\\-1\\0\end{pmatrix}$  $\therefore$ length of projection of AB on q is $\left\|\overrightarrow{AB}\times\frac{1}{\sqrt{6}}\begin{pmatrix}1\\-2\\1\end{pmatrix}\right\|$ $=\frac{1}{\sqrt{6}}\left\|\begin{pmatrix}1\\-1\\0\end{pmatrix}\times\begin{pmatrix}1\\-2\\1\end{pmatrix}\right\|$ $=\frac{1}{\sqrt{6}}\left\|\begin{pmatrix}-1\\-1\\-1\end{pmatrix}\right\|$ $=\frac{1}{\sqrt{6}}\left(\sqrt{3}\right)$ $=\frac{\sqrt{2}}{2}$
4 (v)	Vector equation of line through A and perpendicular to q is $\underset{\sim}{r}=\begin{pmatrix}-1\\2\\4\end{pmatrix}+\beta\begin{pmatrix}1\\-2\\1\end{pmatrix},\ \beta\in\mathbb{R}$. Since line passes through q, $\begin{pmatrix}-1+\beta\\2-2\beta\\4+\beta\end{pmatrix}\cdot\begin{pmatrix}1\\-2\\1\end{pmatrix}=2$ $\therefore\ \beta=\frac{1}{2}$ 

s/n	Solution
	$\therefore\ \overrightarrow{OC} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix} + \frac{1}{2}\begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} = \begin{pmatrix} -\frac{1}{2} \\ 1 \\ \frac{9}{2} \end{pmatrix} = -\frac{1}{2}\underset{\sim}{i} + \underset{\sim}{j} + \frac{9}{2}\underset{\sim}{k}$ Using Mid-point Theorem, $\overrightarrow{OC} = \frac{\overrightarrow{OA} + \overrightarrow{OA'}}{2}$ $\overrightarrow{OA'} = 2\overrightarrow{OC} - \overrightarrow{OA} = 2\begin{pmatrix} -\frac{1}{2} \\ 1 \\ \frac{9}{2} \end{pmatrix} - \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 5 \end{pmatrix}$ $\overrightarrow{A'B} = \overrightarrow{OB} - \overrightarrow{OA'} = \begin{pmatrix} 0 \\ 1 \\ 4 \end{pmatrix} - \begin{pmatrix} 0 \\ 0 \\ 5 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix}$ $\therefore$ equation of required line is $\underset{\sim}{r} = \begin{pmatrix} 0 \\ 0 \\ 5 \end{pmatrix} + \gamma\begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix}, \gamma \in \mathbb{R}$ or $\underset{\sim}{r} = \begin{pmatrix} 0 \\ 1 \\ 4 \end{pmatrix} + \gamma\begin{pmatrix} 0 \\ 1 \\ -1 \end{pmatrix}, \gamma \in \mathbb{R}$ $\therefore$ cartesian equation is $x = 0$, $y = 5 - z$.

Section B

s/n	Solution
5(i)	$X \sim \mathrm{N}(7, \mathrm{Var}(X))$ $Y \sim \mathrm{N}(7, \mathrm{Var}(Y))$ $\mathrm{P}(X < 10) = \mathrm{P}(Y > 6)$ $\mathrm{P}\left(Z < \frac{10-7}{\sqrt{\mathrm{Var}(X)}}\right) = \mathrm{P}\left(Z > \frac{6-7}{\sqrt{\mathrm{Var}(Y)}}\right)$ $\mathrm{P}\left(Z < \frac{3}{\sqrt{\mathrm{Var}(X)}}\right) = \mathrm{P}\left(Z > \frac{-1}{\sqrt{\mathrm{Var}(Y)}}\right)$ 

s/n	Solution
	$\therefore \dfrac{3}{\sqrt{\text{Var}(X)}} = -\left(\dfrac{-1}{\sqrt{\text{Var}(Y)}}\right)$ $3\sqrt{\text{Var}(Y)} = \sqrt{\text{Var}(X)}$ Hence $\text{Var}(X) = 9\text{Var}(Y)$ (shown)
(ii)	$\text{Var}(X) = 9(1) = 9$ $X \sim \text{N}(7, 9)$ $\therefore \text{P}(X < 9) = 0.748$
6(i)	$\text{P}(Y = 2)$ $= 2\text{P}(X_1 = 2 \text{ and } X_2 = 0) + 2\text{P}(X_1 = 3 \text{ and } X_2 = -1)$ $= 2\text{P}(X_1 = 2)\text{P}(X_2 = 0) + 2\text{P}(X_1 = 3)\text{P}(X_2 = -1)$ $= 2\left(\frac{1}{8}\right)\left(\frac{1}{2}\right) + 2\left(\frac{1}{8}\right)\left(\frac{1}{4}\right)$ Since X_1 and X_2 are independent. $= \frac{3}{16}$
(ii)	$\text{P}(\text{max of 2 scores} = -1)$ $= \text{P}(X_1 = -1)\text{P}(X_2 = -1)$ $= \left(\frac{1}{8}\right)^2$ $= \frac{1}{64}$ Let Y be the sum of scores. When sum of scores is prime, then $Y = 2, 3$ or 5. Note that -2 and 1 are not prime numbers. From (i), $\text{P}(Y = 2) = \frac{3}{16}$ $\text{P}(Y = 3) = 2\text{P}(X_1 = 0)\text{P}(X_2 = 3)$ $= 2\left(\frac{1}{2}\right)\left(\frac{1}{4}\right)$ $= \frac{1}{4}$ $\text{P}(Y = 5) = 2\text{P}(X_1 = 3)\text{P}(X_2 = 2)$ $= 2\left(\frac{1}{8}\right)\left(\frac{1}{4}\right)$ $= \frac{1}{16}$ $\therefore$ Expected gain $= 16\left(\frac{1}{64}\right) + 3\left(\frac{3}{16} + \frac{1}{4} + \frac{1}{16}\right) - 2$ $= -0.25$ Hence expected gain is $-\$0.25$.

s/n	Solution
	[Or expected loss is $\$0.25$.] Alternatively, $\therefore$ Expected gain $=(16-2)\left(\frac{1}{64}\right)+(3-2)\left(\frac{3}{16}+\frac{1}{4}+\frac{1}{16}\right)-2\left[1-\left(\frac{1}{64}+\frac{3}{16}+\frac{1}{4}+\frac{1}{16}\right)\right]$ $=-0.25$ Hence expected gain is $-\$0.25$. [Or expected loss is $\$0.25$.]
7(i)	No. of ways $= {}^{10}C_8\,(8-1)! = 226800$
(ii)	<u>Method 1</u>: (method of complementation) No. of ways $= \underbrace{{}^{7}C_5\,(8-1)!}_{\text{No. of ways without restriction [5 other beads, and together with 3 particular beads arranged in a circle]}} - \underbrace{{}^{7}C_5\,3!(6-1)!}_{\text{No. of ways with 3 particular beads all together [5 other beads, with 3 particular beads grouped as 1 unit and 3! ways to arrange among themselves, and all 6 units arranged in a circle]}} = 90720$ <u>Method 2</u>: (method of slotting) Case 1: (all not next to one another) No. of ways $= \underbrace{{}^{7}C_5\,(5-1)!}_{\text{5 other beads used as seperators, and arranged in a circle}} \times \underbrace{{}^{5}C_3\,3!}_{\text{3 out of 5 slots for 3 particular beads, and 3! ways to arrange among themselves}} = 30240$  Case 2: (2 together, 1 not) No. of ways $= \underbrace{{}^{7}C_5\,(5-1)!}_{\text{5 other beads used as seperators, and arranged in a circle}} \times \underbrace{{}^{3}C_2\,2!}_{\text{2 of 3 particular beads together, and 2! ways to arrange among themselves}} \times \underbrace{{}^{5}C_2\,2!}_{\text{2 out of 5 slots for 3 particular beads grouped as 2 units (2 together, 1 not), and 2! ways to arrange among themselves}} = 60480$ $\therefore$ total no. of ways $= 30240 + 60480 = 90720$
(iii)	If spherical beads and cubic beads alternate, then there must be 4 spherical beads and 4 cubic beads. No. of ways $= \underbrace{{}^{5}C_4\,(4-1)!}_{\text{4 spherical beads and arranged in a circle}} \times \underbrace{{}^{5}C_4\,4!}_{\text{4 cubic beads, and 4! ways to arrange among themselves}} = 3600$ 
8(i)	<u>Method 1</u>: (using permutations) Probability $= \frac{10\times 9\times 8\times 7}{10^4} = \frac{63}{125}$ [or 0.504]

s/n	Solution
	Method 2: (using probability) Probability $= \frac{10}{10} \times \frac{9}{10} \times \frac{8}{10} \times \frac{7}{10} = \frac{63}{125}$ [or 0.504]
(ii)	Method 1: (using permutations) thousands, hundreds, tens, unit No. of ways $\underbrace{\boxed{9}\,\boxed{9}\,\boxed{1}}_{\text{3 ways to arrange digit same as last even digit}}\boxed{5}$ Required probability $= \frac{[(9 \times 9 \times 1) \times 3] \times 5}{10^4}$ $= \frac{243}{2000}$ [or 0.1215] Method 2: (using permutations and combinations) Case 1: The other 2 digits are different thousands, hundreds, tens, unit No. of ways $\underbrace{\boxed{{}^9C_2}\,\boxed{1}}_{\text{3! ways to arrange}}\boxed{5}$ Probability $= \frac{[({}^9C_2 \times 1) \times 3!] \times 5}{10^4} = \frac{27}{250}$ [or 0.108] Case 2: The other 2 digits are the same thousands, hundreds, tens, unit No. of ways $\underbrace{\boxed{{}^9C_1}\,\boxed{1}}_{\frac{3!}{2!}\text{ ways to arrange}}\boxed{5}$ Probability $= \frac{[({}^9C_1 \times 1) \times \frac{3!}{2!}] \times 5}{10^4} = \frac{27}{2000}$ [or 0.0135] Required probability $= \frac{27}{250} + \frac{27}{2000} = \frac{243}{2000}$ [or 0.1215] Method 3: (using probability) Case 1: The other 2 digits are different Probability $= \frac{9}{10} \times \frac{8}{10} \times \frac{1}{10} \times \frac{5}{10} \times \frac{3!}{2!} = \frac{27}{250}$ [or 0.108]

<table>
<tr><th>s/n</th><th>Solution</th></tr>
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Case 2: The other 2 digits are the same
$\text{Probability} = \frac{9}{10}\times\frac{1}{10}\times\frac{1}{10}\times\frac{5}{10}\times\frac{3!}{2!} = \frac{27}{2000}$ [or 0.0135]
$\text{Required probability } = \frac{27}{250}+\frac{27}{2000} = \frac{243}{2000}$ [or 0.1215]
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<tr><td>(iii)</td><td>
Let A be the event '4 different digits with 1st digit greater than 6'.
Let B be the event 'odd and even digits that alternate'.

<u>Method 1</u>: (using permutations)
Case 1: 1st digit is even, i.e. 8, and odd and even digits alternate

thousands hundreds tens unit
No. of ways $\boxed{1}\boxed{5}\boxed{4}\boxed{4}$
$\text{Probability } = \frac{1\times5\times4\times4}{10^4} = \frac{1}{125}$ [or 0.008]
Case 2: 1st digit is odd, i.e. 7 or 9, and odd and even digits alternate

thousands hundreds tens unit
No. of ways $\boxed{2}\boxed{5}\boxed{4}\boxed{4}$
$\text{Probability } = \frac{2\times5\times4\times4}{10^4} = \frac{2}{125}$ [or 0.016]
Hence $\mathrm{P}\left(A\cap B\right) = \frac{1}{125}+\frac{2}{125} = \frac{3}{125}$ [or 0.024]
$\mathrm{P}\left(B\right) = \mathrm{P}\left(\text{'odd,even,odd,even' or 'even,odd,even,odd'}\right)$
$= \frac{2\times(5\times5\times5\times5)}{10^4}$
$= \frac{1}{8}$ [or 0.125]
$\therefore\ \mathrm{P}\left(A\,|\,B\right) = \frac{\mathrm{P}\left(A\cap B\right)}{\mathrm{P}\left(B\right)} = \frac{\frac{3}{125}}{\frac{1}{8}} = \frac{24}{125}$ [or 0.192]
<u>Method 2</u>: (using probability)
Case 1: 1st digit is even, i.e. 8, and odd and even digits alternate
$\text{Probability } = \frac{1}{10}\times\frac{5}{10}\times\frac{4}{10}\times\frac{4}{10} = 0.008$
Case 2: 1st digit is odd, i.e. 7 or 9, and odd and even digits alternate
$\text{Probability } = \frac{2}{10}\times\frac{5}{10}\times\frac{4}{10}\times\frac{4}{10} = 0.016$
Hence $\mathrm{P}\left(A\cap B\right) = \frac{1}{125}+\frac{2}{125} = \frac{3}{125}$ [or 0.024]
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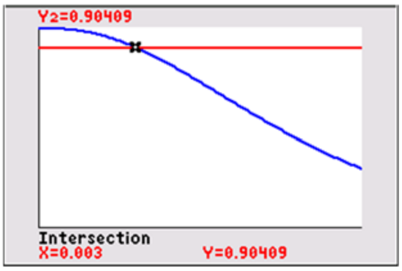
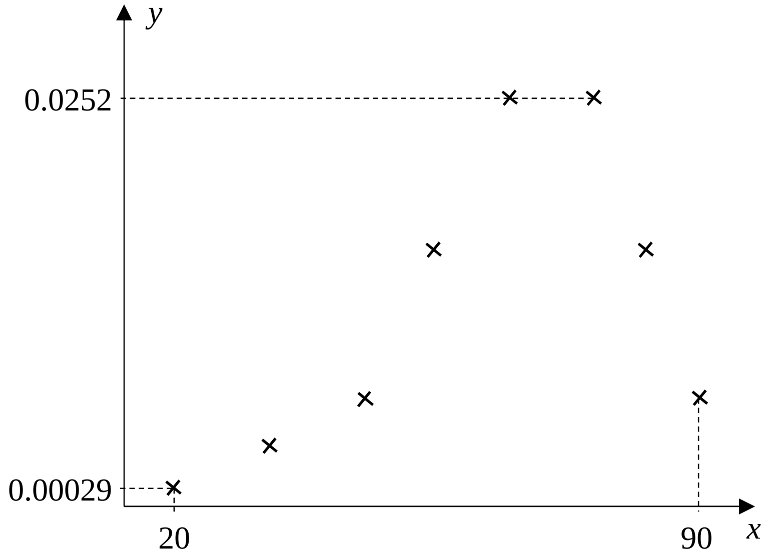
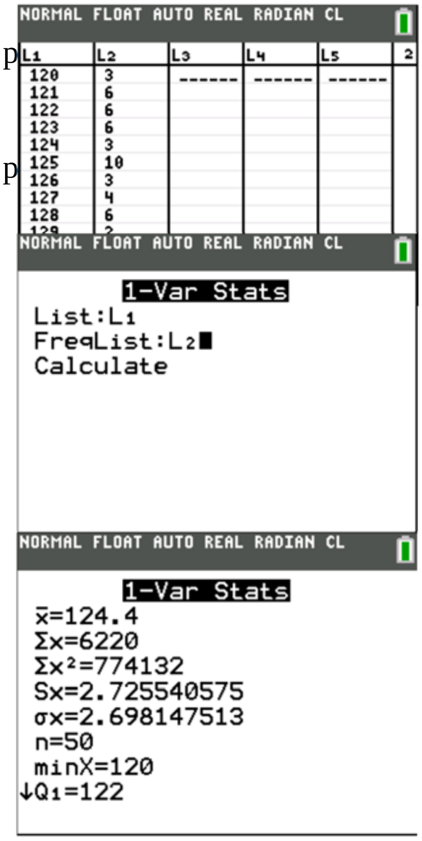
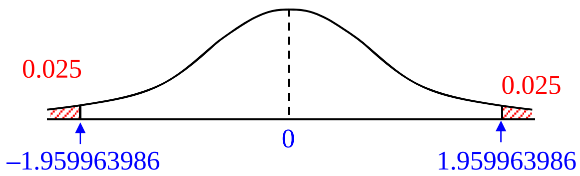
s/n	Solution
	$\mathrm{P}(B)=\mathrm{P}(\text{'odd,even,odd,even' or 'even,odd,even,odd'})$ $=2\times\left(\frac{5}{10}\times\frac{5}{10}\times\frac{5}{10}\times\frac{5}{10}\right)$ $=0.125$ $\therefore\ \mathrm{P}(A\mid B)=\frac{\mathrm{P}(A\cap B)}{\mathrm{P}(B)}=\frac{\frac{3}{125}}{\frac{1}{8}}=\frac{24}{125}$ [or 0.192]
9(i)	Assumptions • The probability of a randomly chosen glass stone being chipped is constant. • Whether a glass stone is chipped or not is independent of that of any other glass stones.
(ii)	$X\sim\mathrm{B}(361,p)$ $\mathrm{P}(X\le 2)=0.90409$ Using GC, $p=0.00300$ 
(iii)	$P(X>2)=1-P(X\le 2)=1-0.90409=0.09591$ Let Y be number of boxes with more than 2 chipped glass stones, out of 20 boxes. $Y\sim\mathrm{B}(20,0.09591)$ $\mathrm{P}(Y>5)=1-\mathrm{P}(Y\le 5)$ $=1-0.9907736392$ $=0.0092263608$ ≈ 0.00923
(iv)	Let A be the number of rejected batches, out of 50 batches. $A\sim\mathrm{B}(50,0.0092263608)$ $\mathrm{E}(A)=50(0.0092264)=0.46132$ $\mathrm{Var}(A)=50(0.0092264)(1-0.0092264)=0.45706$ Let $M_1=A_1+\ldots+A_{20}$ Since $n=20$ is sufficiently large, by CLT, $M_1\sim\mathrm{N}(20\times0.46132,\ 20\times0.45706)$ $=\mathrm{N}(9.2264,\ 9.1412)$ approximately Let $M_2=A_{21}+\ldots+A_{52}$ Since $n=32$ is sufficiently large, by CLT, $M_2\sim\mathrm{N}(32\times0.46132,\ 32\times0.45706)$ $=\mathrm{N}(14.76224,\ 14.62592)$ approximately

s/n	**Solution**
	Let $T = 10M_1 + 20M_2$ Hence $T \sim \mathrm{N}\left(10(9.2264) + 20(14.76224),\ 10^2(9.1412) + 20^2(14.62592)\right)$ $= \mathrm{N}\left(387.5088, 6764.488\right)$ approximately $\therefore\ \mathrm{P}\left(T > 250\right) = 0.952729 \approx 0.953$
10 (i)	
(ii)	The scatter diagram displays a curvilinear relationship which suggests the presence of a maximum point. Hence a linear model is inappropriate.
(iii)	$r = -0.9999984$ (7 decimal places)
(iv)	$m = 65$. Of the 3 negative r values, the r value corresponding to $m = 65$ is closest to -1 .
(v)	Using GC with $m = 65$, $a \approx 0.0022309408 \approx 0.00223$ (to 3 s.f.) $b \approx -3.624598888 \approx -3.62$ (to 3 s.f.) $\therefore\ \ln y = -0.0022309408(x-65)^2 - 3.624598888$ When $x = 45$, $\ln y = -0.0022309408\left(45-65\right)^2 - 3.624598888$ $= -4.516975208$ $\therefore\ y = 0.0109220106 \approx 0.0109$ (to 3 s.f.) Since $x = 45$ is within data range and $r = -0.9999984$ is very close to -1 , the prediction is reliable.

s/n	Solution
11 (a) (i)	Using GC, Unbiased estimate of the p $\bar{x} = 124.4$ g Unbiased estimate of the p $s^2 = 2.725540575^2$ $= 7.428571429$ $= 7.43 \quad$ (3 s.f.) 
(ii)	Let μ g be the **population mean mass** of a box of blueberries. $H_0 : \mu = 125$ $H_1 : \mu < 125$ Under H_0, test statistic $Z = \dfrac{\bar{X} - 125}{\sqrt{\dfrac{7.428571429}{50}}} \sim N(0,1)$ approximately by CLT Level of significance: 10% Critical region: Reject H_0 if *p*-value ≤ 0.1 Since *p*-value $= 0.0598 < 0.1$, we reject H_0 and conclude that at the 10% level of significance, there is sufficient evidence that Yummy Berries Farm has overstated its claim.

s/n	Solution
	No assumptions about masses of boxes of blueberries are needed. Since $n = 50$ is sufficiently large, by **<u>Central Limit Theorem</u>**, the **<u>mean</u>** mass of boxes of blueberries will follows a normal distribution approximately.
(b)	Let μ_1 g be the population mean mass of a box of raspberries. $\mathrm{H}_0 : \mu_1 = 170$ $\mathrm{H}_1 : \mu_1 \neq 170$ Under H_0, assuming n is large, test statistic $Z = \dfrac{\overline{Y} - 170}{\frac{15}{\sqrt{n}}} \sim \mathrm{N}(0,1)$ approximately by CLT Level of significance: 5% Critical region: Reject H_0 if p-value $\leq$ 0.05 i.e. Reject H_0 if z-value ≤ -1.959963986 or z-value ≥ 1.959963986  $\dfrac{165-170}{\frac{15}{\sqrt{n}}} \leq -1.959963986$ or $\dfrac{165-170}{\frac{15}{\sqrt{n}}} \geq 1.959963986$ $\sqrt{n} \geq 5.87989$ or $\sqrt{n} \leq -5.87989$ (rejected) $\therefore\ n \geq 34.573$ Hence least n is 35.