GCE 'A' Level H2 Maths
Nov 2013 Paper 1

1i) $x - 2z = 4$
$2x - 2y + z = 6$
$5x - 4y + 3z = -9$
From GC, point of intersection = $\left(-\frac{38}{3}, -\frac{119}{6}, -\frac{25}{3}\right)$.
(ii) $x - 2z = 4$
$2x - 2y + z = 6$
$5x - 4y = -9$
From GC, there is no solution.
So p, q, r have no common points of intersection.
Since none of the planes are parallel to each other, the 3 planes form a triangular prism.

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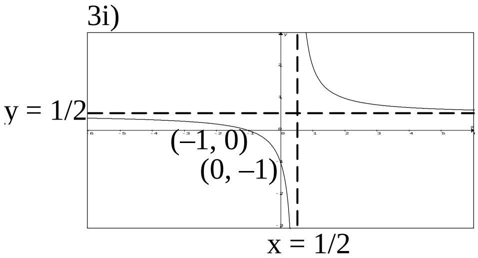
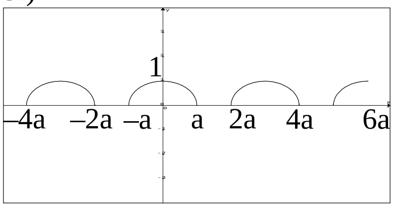
2) $y = \frac{x^2 + x + 1}{x - 1}$
$xy - y = x^2 + x + 1$
$x^2 + x(1 - y) + 1 + y = 0$
For this quadratic equation to have a solution,
$(1 - y)^2 - 4(1 + y) \geq 0$
$y^2 - 2y + 1 - 4 - 4y \geq 0$
$y^2 - 6y - 3 \geq 0$
$y \leq \frac{6 - \sqrt{48}}{2}$ or $y \geq \frac{6 + \sqrt{48}}{2}$
$y \leq 3 - 2\sqrt{3}$ or $y \geq 3 + 2\sqrt{3}$

3i)


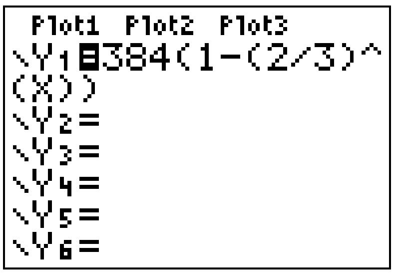
(ii) Let $\frac{x + 1}{2x - 1} = 1$
$x + 1 = 2x - 1$
$x = 2$
$\therefore$ solution is $x < \frac{1}{2}$ or $x > 2$.

4i) $w^3 = (1 + 2i)^3$
$= 1 + 3(2i) + 3(2i)^2 + (2i)^3$
$= 1 + 6i + 3(-4) - 8i$
$= -11 - 2i$
(ii) $a(-11 - 2i) + 5(1 + 4i - 4) + 17(1 + 2i) + b = 0$
$-11a + 2 + b + i(-2a + 54) = 0$
Comparing complex parts:
$-2a + 54 = 0 \Rightarrow a = 27$
Comparing real parts:
$-11a + 2 + b = 0$
$\Rightarrow b = 295$
(iii) Since $1 + 2i$ is a root, so $1 - 2i$ is also a root.
$[\, z - (1 + 2i)\,]\,[\, z - (1 - 2i)\,]$
$= z^2 - 2z + 5$
By comparing coefficients,
$27z^3 + 5z^2 + 17z + 295$
$= (z^2 - 2z + 5)(27z + 59)$
The roots are $1 \pm 2i$ and $-\frac{59}{27}$.

5i)


(ii) $\int_{a/2}^{\sqrt{3}a/2} f(x)\,dx$
$= \int_{\pi/6}^{\pi/3} \sqrt{1 - \sin^2\theta}\; a\cos\theta\,d\theta$
$= a\int_{\pi/6}^{\pi/3} \cos^2\theta\,d\theta$
$= a\int_{\pi/6}^{\pi/3} \frac{1 + \cos 2\theta}{2}\,d\theta$
$= \frac{a}{2}\left[\theta + \frac{\sin 2\theta}{2}\right]_{\pi/6}^{\pi/3}$
$= \frac{a}{2}\left[\frac{\pi}{3} + \frac{\sqrt{3}}{4} - \frac{\pi}{6} - \frac{\sqrt{3}}{4}\right]$
$= \frac{\pi a}{12}$

6i) Equation of plane OAB is $\mathbf{r} = \lambda\mathbf{a} + \mu\mathbf{b}$.
Since C lies on the plane OAB, $\therefore \mathbf{c}$ can be expressed as $\mathbf{c} = \lambda\mathbf{a} + \mu\mathbf{b}$.
(ii) $\overrightarrow{ON} = \frac{4\mathbf{a} + 3\mathbf{c}}{7}$
(iii) Area of ΔONC
$= \frac{1}{2}\left|\frac{4\mathbf{a} + 3\mathbf{c}}{7} \times \mathbf{c}\right|$
$= \frac{2}{7}|\mathbf{a} \times \mathbf{c}|$
$= \frac{2}{7}|\mathbf{a} \times (\lambda\mathbf{a} + \mu\mathbf{b})|$
$= \frac{2\mu}{7}|\mathbf{a} \times \mathbf{b}|$
Area of ΔOMC
$= \frac{1}{2}\left|\frac{1}{2}\mathbf{b} \times \mathbf{c}\right|$
$= \frac{1}{4}|\mathbf{b} \times \mathbf{c}|$
$= \frac{1}{4}|\mathbf{b} \times (\lambda\mathbf{a} + \mu\mathbf{b})|$
$= \frac{\lambda}{4}|\mathbf{a} \times \mathbf{b}|$
$\frac{2\mu}{7}|\mathbf{a} \times \mathbf{b}| = \frac{\lambda}{4}|\mathbf{a} \times \mathbf{b}|$
$\lambda = \frac{8}{7}\mu$

7i) $p = 128\left(\frac{2}{3}\right)^{n-1}$
$\ln p = \ln 128 + (n - 1)\ln\frac{2}{3}$
$= 7\ln 2 + (n-1)\ln 2 - (n-1)\ln 3$
$= (n + 6)\ln 2 + (-n + 1)\ln 3$
$\therefore A = 1, B = 6, C = -1, D = 1.$
(ii) $S_\infty = \frac{128}{1 - \frac{2}{3}}$
$= 384$
$\therefore$ total length cannot be >384 cm.
(iii) $S_n = 128\,\frac{1 - \left(\frac{2}{3}\right)^n}{1 - \frac{2}{3}}$
$= 384\left[1 - \left(\frac{2}{3}\right)^n\right] > 380$
$\left(\frac{2}{3}\right)^n < \frac{1}{96}$
$n > \frac{\log\frac{1}{96}}{\log\frac{2}{3}}$
$= 11.26$
$\therefore$ 12 pieces must be cut off.
Method 2:


X	Y_1
9	374.01
10	377.34
11	379.56
12	381.04
13	382.03
14	382.68
15	383.12

X=12

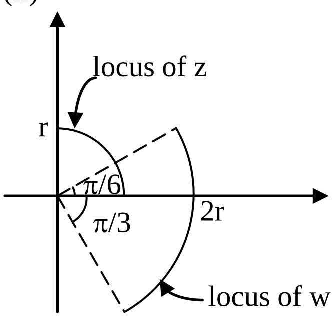
From GC, 12 pieces must be cut off.

8i) $|w| = |1 - i\sqrt{3}|\,|z| = 2r$

$\arg w = \arg(1 - i\sqrt{3}) + \arg z$

$= -\dfrac{\pi}{3} + \theta$

(ii)



(iii) $10 \arg z - 2 \arg w = \pi$

$10\theta - 2\left(\theta - \dfrac{\pi}{3}\right) = \pi$

$8\theta = \dfrac{\pi}{3}$

$\theta = \dfrac{\pi}{24}$

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9) Let P(n) be the statement $\sum_{r=1}^{n} r(2r^2+1) = \dfrac{n}{2}(n+1)(n^2 + n+1)$.

When n = 1:

LHS = 1(2 + 1) = 3

RHS = $\dfrac{1}{2}(2)(3) = 3$ = LHS

$\therefore$ P(1) is true.

Assume that P(k) is true for some $k \in \mathbb{Z}^+$, i.e.

$\sum_{r=1}^{k} r(2r^2+1) = \dfrac{k}{2}(k+1)(k^2 + k +1)$.

To prove that P(k+1) is also true, i.e. $\sum_{r=1}^{k+1} r(2r^2 + 1)$

$= \dfrac{k+1}{2}(k + 2)[(k+1)^2 + k + 2]$

$= \dfrac{k+1}{2}(k + 2)(k^2 + 3k + 3)$.

LHS

$= \sum_{r=1}^{k} r(2r^2+1) + (k+1)[2(k+1)^2+1]$

$= \dfrac{k}{2}(k + 1)(k^2 + k + 1)$
$\quad + (k+1)[2(k+1)^2 + 1]$

$= \dfrac{k+1}{2}[k^3 + k^2 + k + 4(k^2+2k+1)+2]$

$= \dfrac{k+1}{2}(k^3 + 5k^2 + 9k + 6)$

$= \dfrac{k+1}{2}(k + 2)(k^2 + 3k + 3)$

= RHS

Since P(1) is true, and P(k) is true $\Rightarrow$ P(k+1) is true, by Math Induction, P(n) is true for all $n \in \mathbb{Z}^+$.

(ii) $f(r) - f(r - 1)$

$= 2r^3 + 3r^2 + r + 24 - [2(r-1)^3 + 3(r-1)^2 + r-1 + 24]$

$= 2r^3 + 3r^2 + r + 24 - [2(r^3 - 3r^2+3r-1) + 3(r^2-2r+1) + r + 23]$

$= 2r^3 + 3r^2 + r + 24 - [2r^3 - 3r^2 + r + 24]$

$= 6r^2$

$6\sum_{r=1}^{n} r^2 = \sum_{r=1}^{n} [f(r) - f(r - 1)]$

$= f(1) - f(0)$
$+ f(2) - f(1)$
$\vdots$
$+ f(n) - f(n - 1)$
$= f(n) - f(0)$
$= 2n^3 + 3n^2 + n + 24 - 24$

$\sum_{r=1}^{n} r^2 = \dfrac{1}{6}(2n^3 + 3n^2 + n)$

$= \dfrac{n}{6}(2n^2 + 3n + 1)$

$= \dfrac{n}{6}(2n + 1)(n + 1)$

(iii) $\sum_{r=1}^{n} f(r)$

$= \sum_{r=1}^{n} (2n^3 + 3n^2 + n + 24)$

$= \sum_{r=1}^{n} r(2r^2 + 1) + 3\sum_{r=1}^{n} r^2 + \sum_{r=1}^{n} 24$

$= \dfrac{n}{2}(n+1)(n^2 + n+1) + \dfrac{n}{2}(2n+1)(n + 1) + 24n$

10i) $\displaystyle\int \frac{1}{3-2z}\,dz = \int dx$

$-\dfrac{1}{2}\ln(3 - 2z) = x + C$

$\ln(3 - 2z) = -2x - 2C$

$3 - 2z = e^{-2x-2C}$

$2z = 3 - e^{-2x-2C}$

$z = \dfrac{3}{2} - \dfrac{1}{2}e^{-2x}e^{-2C}$

$= \dfrac{3}{2} + Ae^{-2x}$ where $A = \dfrac{1}{2}e^{-2C}$

(ii) $\dfrac{dy}{dx} = \dfrac{3}{2} + Ae^{-2x}$

$y = \dfrac{3}{2}x - \dfrac{A}{2}e^{-2x} + D$

(iii) $\dfrac{d^2y}{dx^2} = -2Ae^{-2x}$

$= -2\left(\dfrac{dy}{dx} - \dfrac{3}{2}\right)$

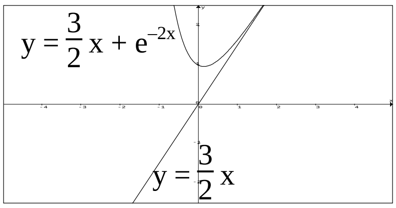
$= -2\dfrac{dy}{dx} + 3$

$\therefore a = -2,\ b = 3$

(iv) Let A = 0.

2 members of the family are $y = \dfrac{3}{2}x$ and $y = \dfrac{3}{2}x + 1$.

Let A = –2, D = 0: $y = \dfrac{3}{2}x + e^{-2x}$.



11i) $\dfrac{dx}{dt} = 6t,\ \dfrac{dy}{dt} = 6t^2$

$\dfrac{dy}{dx} = \dfrac{6t^2}{6t} = t$

Equation of tangent is

$y - 2t^3 = t(x - 3t^2)$

$y = tx - 3t^3 + 2t^3$

$= tx - t^3$

(ii) Equate $y = px - p^3$ with $y = qx - q^3$:

$px - p^3 = qx - q^3$

$(p - q)x = p^3 - q^3$

$$x = \frac{(p-q)(p^2+pq+q^2)}{p-q}$$
$$= p^2 + pq + q^2$$
$$y = p(p^2+pq+q^2) - p^3$$
$$= p(p^2 + pq)$$
$$= pq(p+q)$$
$$y^2 + 1 = p^2q^2(p+q)^2 + 1$$
$$= (p+q)^2 + 1$$
$$= p^2 + 2pq + q^2 + 1$$
$$= p^2 + 2pq + q^2 - pq$$
$$= p^2 + q^2 + pq$$
$$= x$$

$\therefore$ R lies on the curve $x = y^2 + 1$.

(iii) Substitute $x = 3t^2$, $y = 2t^3$ into $x = y^2 + 1$:

$$3t^2 = (2t^3)^2 + 1$$
$$= 4t^6 + 1$$
$$\therefore 4t^6 - 3t^2 + 1 = 0$$
$$(t^2+1)(4t^4 - 4t^2 + 1) = 0$$
$$(t^2+1)(2t^2-1)^2 = 0$$
$$t^2 = \frac{1}{2}$$

$t = \frac{1}{\sqrt{2}}$ since $y > 0$

$x = \frac{3}{2}$, $y = \frac{1}{\sqrt{2}}$.

$\therefore M = (\frac{3}{2}, \frac{1}{\sqrt{2}})$.

(iv) Area

$$= \int_0^{3/2} y\,dx - \int_1^{3/2} \sqrt{x-1}\,dx$$
$$= \int_0^{1/\sqrt{2}} 2t^3\, 6t\,dt - \left[\frac{(x-1)^{3/2}}{3/2}\right]_1^{3/2}$$
$$= 12\int_0^{1/\sqrt{2}} t^4\,dt - \frac{2}{3}\left[\frac{1}{2\sqrt{2}}\right]$$
$$= 12\left[\frac{t^5}{5}\right]_0^{1/\sqrt{2}} - \frac{1}{3\sqrt{2}}$$
$$= \frac{3}{5\sqrt{2}} - \frac{1}{3\sqrt{2}}$$
$$= \frac{4}{15\sqrt{2}}$$

GCE 'A' Level H2 Maths Nov 2013 Paper 2

1i) $R_g = \mathbb{R} \not\subseteq \mathbb{R}\backslash\{1\} = D_f$

$\therefore$ fg does not exist.

(ii) gf(x)

$$= g\left(\frac{2+x}{1-x}\right)$$
$$= 1 - 2\left(\frac{2+x}{1-x}\right)$$
$$= 1 - \frac{4+2x}{1-x}$$
$$= \frac{1-x-(4+2x)}{1-x}$$
$$= -\frac{3+3x}{1-x}$$

Let $y = (gf)^{-1}(5)$

$$gf(y) = 5$$
$$-\frac{3+3y}{1-y} = 5$$
$$-3 - 3y = 5 - 5y$$
$$2y = 8$$
$$y = 4$$

(2i) Length of side of base

$$= a - 2\frac{x}{\tan 30°}$$
$$= a - \frac{2x}{1/\sqrt{3}}$$
$$= a - 2x\sqrt{3}$$

Volume of prism, V

$$= \frac{1}{2}(a - 2x\sqrt{3})^2 \sin 60°\ x$$
$$= \frac{x\sqrt{3}}{4}(a - 2x\sqrt{3})^2$$

(ii) $$\frac{dV}{dx} = \frac{\sqrt{3}}{4}(a - 2x\sqrt{3})^2 + \frac{x\sqrt{3}}{4}2(a - 2x\sqrt{3})(-2\sqrt{3})$$
$$= \frac{\sqrt{3}}{4}(a - 2x\sqrt{3})(a - 2x\sqrt{3} - 4x\sqrt{3})$$
$$= \frac{\sqrt{3}}{4}(a - 2x\sqrt{3})(a - 6x\sqrt{3}) = 0$$
$$x = \frac{a}{2\sqrt{3}} \text{ or } \frac{a}{6\sqrt{3}}$$

$$\frac{d^2V}{dx^2} = \frac{\sqrt{3}}{4}(-2\sqrt{3})(a - 6x\sqrt{3}) + \frac{\sqrt{3}}{4}(a - 2x\sqrt{3})(-6\sqrt{3})$$
$$= -\frac{3}{2}(a - 6x\sqrt{3} + 3a - 6x\sqrt{3})$$
$$= -\frac{3}{2}(4a - 12x\sqrt{3})$$
$$= 6(3x\sqrt{3} - a)$$

When $x = \frac{a}{2\sqrt{3}}$, $\frac{d^2V}{dx^2} = 3a > 0$.

When $x = \frac{a}{6\sqrt{3}}$, $\frac{d^2V}{dx^2} = -3a < 0$.

$\therefore$ maximum V

$$= \frac{a}{6\sqrt{3}}\frac{\sqrt{3}}{4}(a - \frac{a}{3})^2$$
$$= \frac{a}{24}(\frac{2a}{3})^2$$
$$= \frac{a^2}{54}$$

(3i) $$f'(x) = \frac{2\cos x}{1 + 2\sin x}$$

$$f''(x) = \frac{(1+2\sin x)(-2\sin x) - (2\cos x)^2}{(1+2\sin x)^2}$$
$$= \frac{-2\sin x - 4\sin^2 x - 4\cos^2 x}{(1+2\sin x)^2}$$
$$= \frac{-2\sin x - 4}{(1+2\sin x)^2}$$

$$f'''(x) = \frac{(1+2\sin x)^2(-2\cos x) + (2\sin x + 4)2(1+2\sin x)2\cos x}{(1+2\sin x)^4}$$

$f(0) = 0$

$f'(0) = 2$

$f''(0) = -4$

$f'''(0) = -2 + 16 = 14$

$$f(x) = 0 + 2x - \frac{4}{2}x^2 + \frac{14}{6}x^3 + \ldots$$
$$= 2x - 2x^2 + \frac{7}{3}x^3 + \ldots$$

(ii) $e^{ax} \sin nx$

$$= (1 + ax + \frac{a^2x^2}{2} + \ldots)(nx - \frac{n^3x^3}{6} + \ldots)$$
$$= nx + anx^2 + \ldots = 2x - 2x^2 + \ldots$$

$\therefore n = 2, a = -1$

Third non–zero term

$$= \frac{a^2n}{2}x^3 - \frac{n^3x^3}{6}$$
$$= x^3 - \frac{4}{3}x^3$$
$$= -\frac{1}{3}x^3$$

(4i) $\cos\theta = \left|\dfrac{\begin{pmatrix}2\\-2\\1\end{pmatrix}\bullet\begin{pmatrix}-6\\3\\2\end{pmatrix}}{\sqrt{9}\sqrt{49}}\right|$

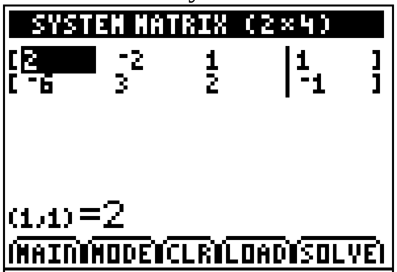
$= \dfrac{|-12-6+2|}{3\times 7}$

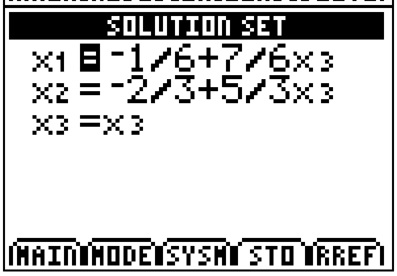
$= \dfrac{16}{21}$

$\theta = 40.4°$

(ii) $2x - 2y + z = 1$

$-6x + 3y + 2z = -1$





From GC, equation of line *l* is **r** $= \begin{pmatrix}-1/6\\-2/3\\0\end{pmatrix} + \lambda\begin{pmatrix}7/6\\5/3\\1\end{pmatrix}$, $\lambda\in\mathbb{R}$

(iii) Distance from A to p_1

$= \left|\dfrac{\begin{pmatrix}2\\-2\\1\end{pmatrix}\bullet\begin{pmatrix}4\\3\\c\end{pmatrix} - 1}{\sqrt{9}}\right|$

$= \dfrac{|1+c|}{3}$

Distance from A to p_2

$= \left|\dfrac{\begin{pmatrix}-6\\3\\2\end{pmatrix}\bullet\begin{pmatrix}4\\3\\c\end{pmatrix} + 1}{\sqrt{49}}\right|$

$= \dfrac{|2c-14|}{7}$

$\dfrac{|1+c|}{3} = \dfrac{|2c-14|}{7}$

$49(1+c)^2 = 9(2c-14)^2$

$49(1 + 2c + c^2) = 9(4c^2 - 56c + 196)$

$13c^2 + 602c - 1715 = 0$

$c = -49, 2.69$

(5i) Print the names of all 100 000 employees on slips of paper and put in a box. Randomly pick 90 names from the box.

There may be too many representatives from some countries, and none from some countries.

(ii) Use stratified sampling. The number of employees from each country to be invited to the party is proportional to the number of employees in that country. Eg, if Singapore has n employees, then invite $\dfrac{n}{100\ 000}\times 90$ employees from Singapore. Use random sampling to pick required number of employees from each country.

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(6) $P(Y < 2a) = 0.95$

$P\left(Z < \dfrac{2a-\mu}{\sigma}\right) = 0.95$

$\dfrac{2a-\mu}{\sigma} = 1.64485$

$2a - \mu = 1.64485\sigma$ ——(1)

$P(Y < a) = 0.25$

$P\left(Z < \dfrac{a-\mu}{\sigma}\right) = 0.25$

$\dfrac{a-\mu}{\sigma} = -0.67449$

$a - \mu = -0.67449\sigma$ ——(2)

$(1) - (2) \Rightarrow a = 2.31934\sigma$

$\mu = a + 0.67449\dfrac{a}{2.31934}$

$= 1.29a$

(7i) The probability of picking a packet containing a free gift is constant.

Whether a packet contains a free gift or not is independent of other packets.

(ii) $F \sim B(20, \frac{1}{20})$

$P(F = 1) = 0.377$

(iii) $F \sim B(60, \frac{1}{20})$

Since $n = 60 > 50$ and $np = 3 < 5$, $F \sim Po(3)$ approximately.

$P(F \geq 5) = 1 - P(F \leq 4)$

$= 0.185$

(8i) $P(B \mid A') = \dfrac{P(B\cap A')}{P(A')}$

$\therefore P(B\cap A') = 0.8 \times 0.3$

$= 0.24$

(ii)

$P(A') = P(A'\cap B) + P(A'\cap B')$

$\therefore P(A'\cap B') = 0.3 - 0.24$

$= 0.06$

(iii) $P(A \mid B') = \dfrac{P(A\cap B')}{P(B')}$

$0.88 = \dfrac{P(A\cap B')}{P(A\cap B') + P(A'\cap B')}$

$0.88\,P(A\cap B') + 0.88\times 0.06 = P(A\cap B')$

$0.12\,P(A\cap B') = 0.0528$

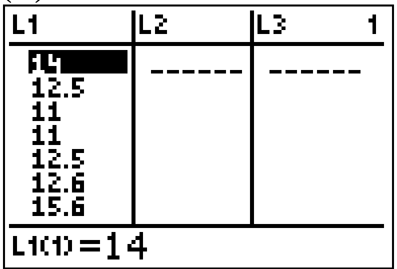
$P(A\cap B') = 0.44$

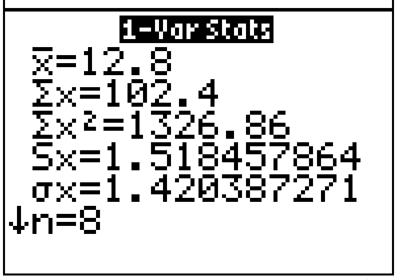
$P(A) = P(A\cap B) + P(A\cap B')$

$0.7 = P(A\cap B) + 0.44$

$P(A\cap B) = 0.26$

(9i)





From GC, unbiased estimate of $\mu = 12.8$ and unbiased estimate of $\sigma^2 = 1.51846^2$

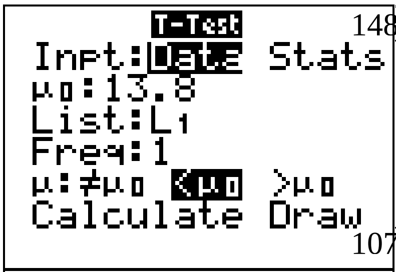
$= 2.3057$

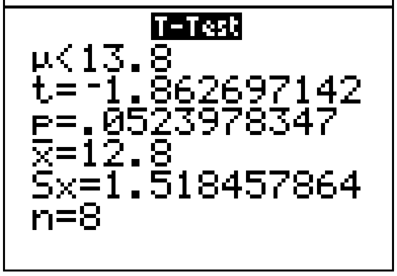
$= 2.31$

(ii) We assume that 2.31 is a good estimate of the unknown the population variance.

$H_0 : \mu = 13.8$

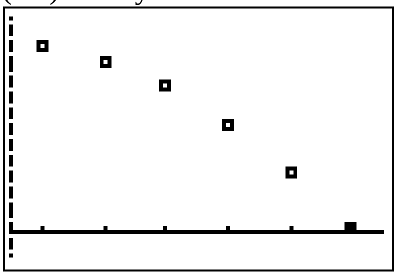
$H_1 : \mu < 13.8$



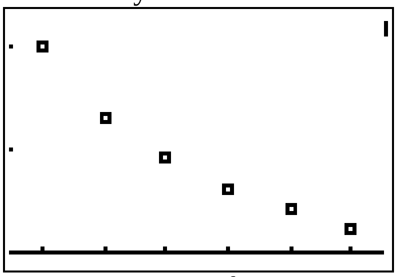


Since p–value = 0.0524 > 0.05, we do not reject H_0 . There is insufficient evidence at 5% significance level to say that the distance travelled per litre of fuel is too high.

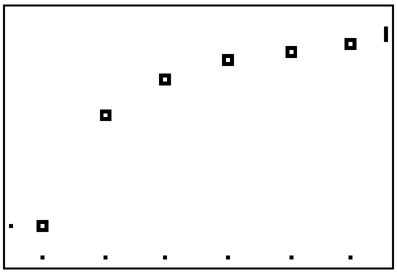
(10i) A: $y = a + bx^2$



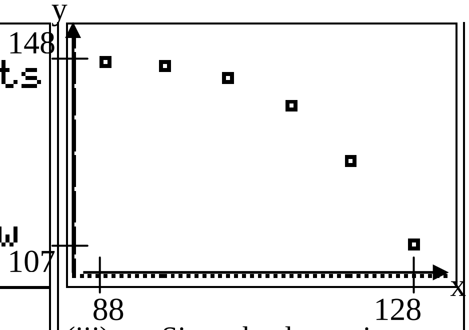
B: $y = c + d \ln x$



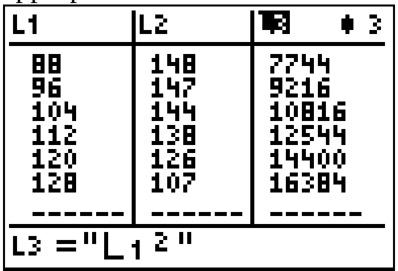
C: $y = e + \frac{f}{x}$

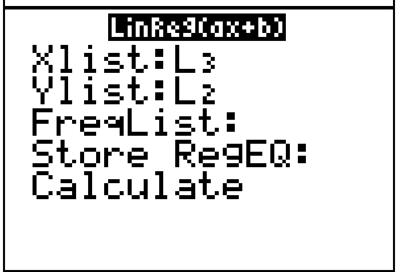


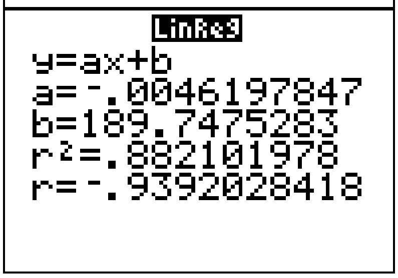
(ii)



(iii) Since the data points seem to lie close to a curve with negative gradient and concave downwards, model A is the most appropriate.







From GC, r = –0.939

(iv)

From GC, regression line is

$y = 189.748 – 0.0046198x^2$

Distance travelled

$= 189.748 – 0.0046198\,(110^2)$

= 133.8

= 134 km

(11i) $\dfrac{26\times25\times24\times9\times8}{26\times26\times26\times9\times9}$

= 0.789

(ii) $\dfrac{1 – P(\text{same digits})}{2}$

$= \dfrac{1-\frac{9}{9^2}}{2}$

$= \dfrac{4}{9}$

(iii) Case 1: exactly 2 same letters and 2 different digits

No. of ways $= 26 \times 25\times \frac{3!}{2!} \times {}^9P_2$

= 140 400

Case 2: all letters different and 2 same digits

No. of ways $= {}^{26}P_3 \times 9$

= 140 400

Case 3: 3 same letters and 2 same digits

No. of ways $= 26 \times 9$

= 234

Probability

$= \dfrac{140\,400 + 140\,400 + 234}{26\times26\times26\times9\times9}$

= 0.197

(iv) Case 1: 2 different consonants, 1 vowel and 1 even digit

No. of ways

$= {}^{21}C_2\ {}^5C_1\ 3!\ {}^4C_1\ {}^5C_1\ 2!$

= 252 000

Case 2: 2 same consonants, 1 vowel and 1 even digit

No. of ways

$= {}^{21}C_1\ {}^5C_1\ \frac{3!}{2!}\ {}^4C_1\ {}^5C_1\ 2!$

= 12 600

Probability $= \dfrac{252\,000 + 12\,600}{26\times26\times26\times9\times9}$

= 0.186

(12i) The mean no. of absentees per unit time is constant.

The probability of an employee being absent is independent of other employees.

The mean no. of absentees may be higher during an epidemic.

If an employee is ill, his illness may be contagious and will increase the probability of other employees becoming ill.

(ii) Let A = no. of absentees from Admin Dept on n days.

A ~ Po(1.2n)

$P(A = 0) = e^{-1.2n} < 0.01$

$-1.2n < \ln 0.01$

$n > 3.8$

Smallest no. of days = 4

(iii) Let T = no. of days of absence from the 2 depts in 5 days

$T \sim Po((1.2 + 2.7)5)$

$= Po(19.5)$

$P(T > 20) = 1 - P(T \leq 20)$

$= 0.397$

(iv) Let S = no. of days of absence from the 2 depts in 60 days.

$S \sim Po((1.2 + 2.7)60)$

$= Po(234)$

Since $\lambda = 234 > 10$, $S \sim N(234, 234)$ approximately.

$P(200 \leq S \leq 250)$

$= P(199.5 \leq S \leq 250.5)$

$= 0.848$