

**MATHEMATICS (H1)**  
 Paper 1 Suggested Solutions

**8864/01**  
**October/November 2010**

1. **Topic: Equations & Inequalities (Quadratic Roots)**

$$4x^2 - 2kx + 9 = 0$$

For two real distinct roots to exist, discriminant  $b^2 - 4ac > 0$ :

$$(-2k)^2 - 4(4)(9) > 0$$

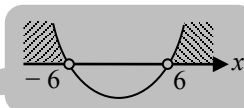
$$4k^2 - (12)^2 > 0$$

$$(2k-12)(2k+12) > 0$$

$$2k+12 < 0 \quad \text{or} \quad 2k-12 > 0$$

$$k < -6 \quad \text{or} \quad k > 6$$

For two real and *distinct* roots,  
 discriminant  $> 0$  (no equal sign)  
 $a = 4, b = -2k, c = 9$



$\therefore$  The set of values of  $k$  for the equation to have two real and distinct roots is  
 $\{k \in \mathbb{R}: k < -6 \text{ or } k > 6\}$

Note: Final answer expressed in set notation as question asks for set of values of  $k$ .

2. **Topic: Integration**

$$(i) \int e^{1-2x} dx = -\frac{1}{2}e^{1-2x} + c$$

$$\int e^{ax+b} = \frac{1}{a}e^{ax+b} + c$$

$$(ii) \int \frac{2}{(x+1)^3} dx = 2 \int (x+1)^{-3} dx$$

$$= (2) \frac{(x+1)^{-2}}{-2} + c$$

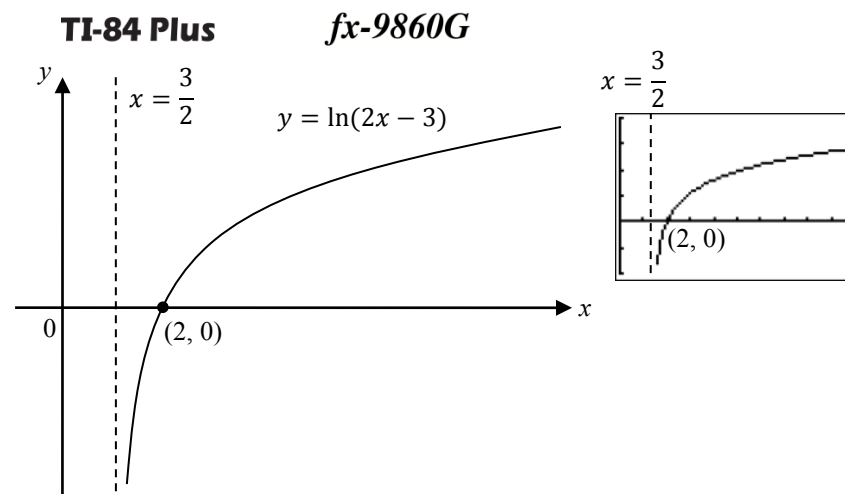
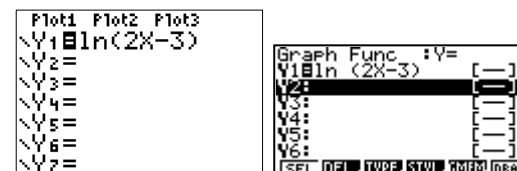
$$= -\frac{1}{(x+1)^2} + c$$

$$\int (ax+b)^n dx = \frac{(ax+b)^{n+1}}{a(n+1)} + c$$

3. **Topic: Graphs**

$$(i) y = \ln(2x-3) \Rightarrow \text{Equation of asymptote: } 2x-3=0 \Rightarrow x=\frac{3}{2}$$

Using G. C. (refer to Appendix for detailed steps),



$$(ii) y = \ln(2x-3)$$

$$\frac{dy}{dx} = \frac{2}{2x-3}$$

$$\frac{d}{dx} \ln(ax+b) = \frac{a}{ax+b}$$



(iii) When  $x = 3$ ,

$$y = \ln[2(3) - 3] = \ln 3$$

$$\text{Gradient of tangent, } m_T = \frac{2}{2(3)-3} = \frac{2}{3}$$

$$\Rightarrow \text{Gradient of normal, } m_N = -\frac{1}{m_T} = -\frac{3}{2}$$

$\therefore$  Equation of normal:

$$y - \ln 3 = -\frac{3}{2}(x - 3)$$

$$2y - 2\ln 3 = -3x + 9$$

$$3x + 2y = 9 + 2\ln 3$$

Sub  $x = 3$  into  $\frac{dy}{dx}$   
 obtained in (ii).

Equation of straight line with  
 gradient  $m$  passing through  $(x_1, y_1)$ :  
 $y - y_1 = m(x - x_1)$

#### 4. Topic: Differentiation (Maxima & Minima)

(i) Given  $AB = 2x$  m

$$\Rightarrow AE = \frac{5}{8}AB = \frac{5}{4}x \text{ m}$$

Since  $ABCD$  is a rectangle,

$$\Rightarrow AD = BC$$

$$\Rightarrow DC = AB = 2x$$

Given total perimeter  $AEB CDA = 6$  m

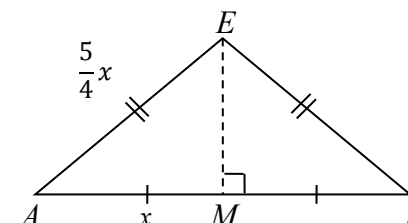
$$AE + EB + BC + CD + AD = 6$$

$$\frac{5}{4}x + \frac{5}{4}x + 2AD + 2x = 6$$

$$2AD = 6 - \frac{9}{2}x$$

$$AD = \left(3 - \frac{9}{4}x\right) \text{ m (shown)}$$

(ii) Since  $\triangle AEB$  is isosceles,



$$AM = MB = x(EM \perp AB)$$

$$EM = \sqrt{\left(\frac{5}{4}x\right)^2 - x^2} = \frac{3}{4}x$$

By Pythagoras' theorem

$\therefore$  Area of the window,  $A = \text{Area of } \triangle AEB + \text{Area of rectangle } ABCD$

$$= \frac{1}{2}(2x)\left(\frac{3}{4}x\right) + (2x)\left(3 - \frac{9}{4}x\right)$$

$$= \frac{3}{4}x^2 + 6x - \frac{9}{2}x^2$$

$$= \left(6x - \frac{15}{4}x^2\right) \text{ m}^2 \text{ (shown)}$$

Length of  $AD$   
 shown in part (i)

(iii)  $A$  is maximum when  $\frac{dA}{dx} = 0$  i.e.

$$\frac{dA}{dx} = 6 - \frac{15}{2}x = 0$$

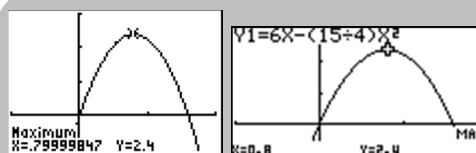
$$x = \frac{4}{5} \text{ m}$$

By 2<sup>nd</sup> derivative test,  $\frac{d^2A}{dx^2} = -\frac{15}{2} < 0 \Rightarrow A$  is maximum when  $x = \frac{4}{5}$ .

$$\therefore A_{\max} = 6\left(\frac{4}{5}\right) - \frac{15}{4}\left(\frac{4}{5}\right)^2 = \frac{12}{5} \text{ m}^2$$

Second Derivative Test:

Sign of $\frac{d^2y}{dx^2}$	Nature of stationary point
-	Maximum
+	Minimum
0	Point of inflexion



**TI-84 Plus**

**fx-9860G**

Check final answer with G. C. (time permitting)



5. **Topic : Applications of Differentiation & Integration**

(i) Given  $y = 6 - 4x^3 - 3x^4$

$$\frac{dy}{dx} = -12x^2 - 12x^3 = -12x^2(1+x)$$

At stationary points,  $\frac{dy}{dx} = 0$

$$-12x^2(1+x) = 0$$

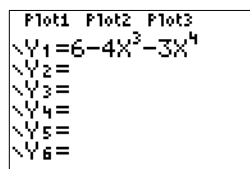
$$x = 0 \quad \text{or} \quad x = -1$$

$$y = 6 \quad \text{or} \quad y = 6 - 4(-1)^3 - 3(-1)^4 = 7$$

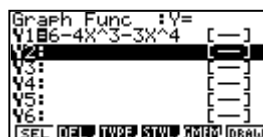
$\therefore$  Stationary points of curve  $C$  are **(0, 6) and (-1, 7)**

Final answer should be given in coordinates.

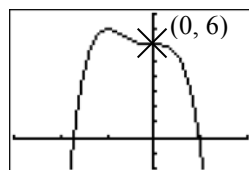
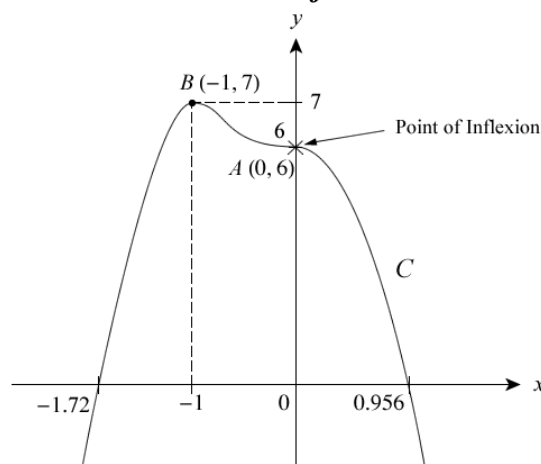
(ii) Using G. C. (refer to Appendix for detailed steps),



**TI-84 Plus**



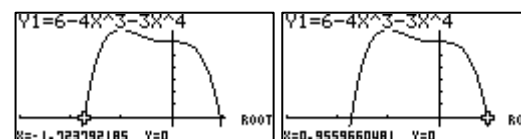
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(iii) Using G. C. (refer to Appendix for detailed steps),



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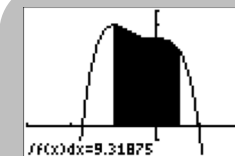
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$\therefore$   $x$ -coordinates are **-1.72 (2d.p.) and 0.96 (2d.p.)**

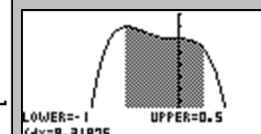
(iv)  $\int (6 - 4x^3 - 3x^4) dx = 6x - x^4 - \frac{3}{5}x^5 + c$

$$\therefore \text{Area} = \int_{-1.72}^{0.96} (6 - 4x^3 - 3x^4) dx$$

$$\begin{aligned} &= \left[ 6x - x^4 - \frac{3}{5}x^5 \right]_{-1.72}^{0.96} \\ &= \left[ 6\left(\frac{1}{2}\right) - \left(\frac{1}{2}\right)^4 - \frac{3}{5}\left(\frac{1}{2}\right)^5 \right] - \left[ 6(-1) - (-1)^4 - \frac{3}{5}(-1)^5 \right] \\ &= 9\frac{51}{160} \text{ units}^2 \end{aligned}$$



**TI-84 Plus**



**fx-9860G**

Check final answer with G. C. (time permitting)

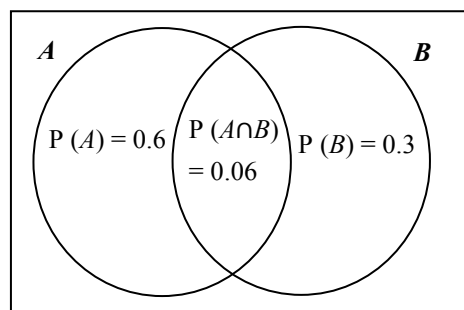
6. **Topic: Probability (Venn Diagram)**

$$\begin{aligned} \text{(i)} \quad P(\text{both } A \text{ and } B \text{ occur}) &= P(A \cap B) \\ &= P(A|B)P(B) \quad P(A|B) = \frac{P(A \cap B)}{P(B)} \\ &= 0.2 \times 0.3 \\ &= \mathbf{0.06} \end{aligned}$$

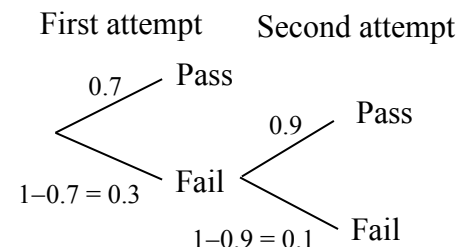
$$\begin{aligned} \text{(ii)} \quad P(\text{at least one of } A \text{ and } B \text{ occurs}) &= P(A \cup B) \\ &= P(A) + P(B) - P(A \cap B) \\ &= 0.6 + 0.3 - 0.06 \\ &= \mathbf{0.84} \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad P(\text{exactly one of } A \text{ and } B \text{ occurs}) &= P(A \cup B) - P(A \cap B) \\ &= 0.84 - 0.06 \\ &= \mathbf{0.78} \end{aligned}$$

Venn Diagram (for illustration):



7. **Topic: Probability (Probability Tree)**



$$\begin{aligned} \text{(i)} \quad P(\text{fails at both attempt}) &= 0.3 \times 0.1 \\ &= \mathbf{0.03} \\ \text{(ii)} \quad P(\text{passes the examination}) &= 1 - 0.03 = 0.97 \\ P(\text{pass at 2}^{\text{nd}} \text{ attempt}) &= P(\text{fail on 1}^{\text{st}} \text{ attempt AND pass at 2}^{\text{nd}} \text{ attempt}) \\ &= 0.3 \times 0.9 = 0.27 \end{aligned}$$

P (pass at second attempt | passes the exam)

$$\begin{aligned} P(A|B) &= \frac{P(A \cap B)}{P(B)} \\ &= \frac{P(\text{pass at 2nd attempt} \cap \text{passes the exam})}{P(\text{passes the exam})} \\ &= \frac{P(\text{pass at 2nd attempt})}{P(\text{passes the exam})} \\ &= \frac{0.27}{0.97} \\ &= \frac{27}{97} \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad P(\text{two pass at the 1st attempt and the other passes at 2}^{\text{nd}} \text{ attempt}) &= (0.7 \times 0.7) \times 0.27 \times 3 \text{ cases} \\ &= 0.3969 \\ &\approx \mathbf{0.397 \text{ (3 sig. fig.)}} \end{aligned}$$

3 Possibilities:  
 Case 1: 1<sup>st</sup> & 2<sup>nd</sup> students pass at 1<sup>st</sup> attempt  
 Case 2: 2<sup>nd</sup> & 3<sup>rd</sup> students pass at 1<sup>st</sup> attempt  
 Case 3: 3<sup>rd</sup> & 1<sup>st</sup> students pass at 1<sup>st</sup> attempt

8. Topic: Sampling and Hypothesis Testing

- (i) To obtain a stratified sample of 60 students, we divide the population into the following strata: Year One students, Year Two students and Year Three students.

We then pick random samples of the following sizes within each stratum:

$$\frac{1400}{3000} \times 60 = 28 \text{ Year One students}$$

$$\frac{900}{3000} \times 60 = 18 \text{ Year Two students}$$

$$\frac{700}{3000} \times 60 = 14 \text{ Year Three students}$$

Year One:  $\frac{1400}{3000}$  of population

Year Two:  $\frac{900}{3000}$  of population

Year Three:  $\frac{700}{3000}$  of population

- (ii) Stratified sampling provides a more accurate representation of the large and varied student population, since the amount spent may vary according to year. As such, stratified sampling allows data for each year to be examined separately whereas this cannot be achieved with simple random sampling.

- (iii) Given  $\Sigma x = 10450$ ,  $\Sigma x^2 = 2\,235\,000$ ,  $n = 50$ .

Unbiased estimate of  $\mu = \frac{\Sigma x}{n} = \frac{10450}{50} = 209$

Unbiased estimate of population mean,  
 $\hat{\mu} = \frac{\Sigma x}{n}$

Unbiased estimate of  $\sigma^2 = \frac{1}{n-1} \left[ \Sigma x^2 - \frac{(\Sigma x)^2}{n} \right]$   
 $= \frac{1}{50-1} \left[ 2235000 - \frac{(10450)^2}{50} \right]$   
 $= 1039 \frac{39}{49}$

Unbiased variance estimate formula from MF15.

- (iv) 1. By the Central Limit Theorem, we assume that the amount of money spent by a student,  $X$ , is normally distributed, since the sample size is sufficiently large ( $n \geq 50$ ).
2. Since  $\sigma^2$  is not given, we assume that the value of the unbiased estimate of  $\sigma^2$  computed in (iii) is sufficiently close to the actual population variance.

9. Topic: Binomial Distribution & Its Normal Approximation

- (i) Let  $X$  be the random variable for the number of germinating sunflower seeds out of 8 sown, where

$$X \sim B(8, 0.7)$$

Binomial Distribution:

$X \sim B(n, p)$  where  $n$  = no. of trials = 8  
 $p$  = probability of success = 0.7 (given)

Using G. C. (refer to Appendix for detailed steps),

binompdf(8,0.7,6)  
 .29647548

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$$P(X=6) = 0.29647 \approx 0.296 \text{ (3 sig.fig)}$$

Binomial P.D  
 Data :Variable  
 x :6  
 Numtrial:8  
 P :0.7  
 Save Res:None  
 Execute  
 ICalc

**fx-9860G**

Binomial P.D  
 P=0.29647548

G. C.'s binomial probability (PD) function is used.

- (ii)  $P(X \geq 6) = 1 - P(X \leq 5)$

Using G. C. to calculate  $P(X \leq 5)$  (refer to Appendix for detailed steps),

binomcdf(8,0.7,5)  
 .4482261914

**TI-84 Plus**

$$\therefore P(X \geq 6) = 1 - 0.44823 = 0.55177 \approx 0.552 \text{ (3 sig.fig)}$$

Binomial C.D  
 Data :Variable  
 x :5  
 Numtrial:8  
 P :0.7  
 Save Res:None  
 Execute  
 ICalc

**fx-9860G**

Binomial C.D  
 P=0.44822619

G. C.'s binomial cumulative probability (CD) function is used.

Let  $Y$  be the random variable for the number of germinating sunflower seeds out of 60 sown, where  $Y \sim B(60, 0.7)$ .

Since  $n = 60 > 50$  and  $p = 0.7$ ,

$$np = 60 \times 0.7 = 42 > 5$$

$$nq = 60 \times (1 - 0.7) = 18 > 5$$

Since  $np > 5$  and  $nq > 5$ , we use a normal distribution to approximate the binomial distribution with

$$E(Y) = np = 42$$

$$\text{Var}(Y) = npq = 60 \times 0.7 \times 0.3 = 12.6$$

$\Rightarrow Y \sim N(42, 12.6)$  approximately

$P(Y < 40) \rightarrow P(Y < 39.5)$  by continuity correction.

Using G. C. (refer to Appendix for detailed steps),

```
normalcdf(-E99,39.5,42,12.6)
.2406243994
```

**TI-84 Plus**

```
Normal C.D
Lower: -1E+99
Upper: 39.5
σ: 3.54964786
μ: 42
Save Res: None
execute
1/calc
```

**fx-9860G**

```
Normal C.D
P = 0.24062447
Z: Low = -2.817E+98
Z: Up = -0.7042952
```

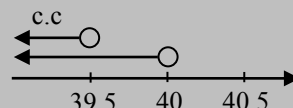
When  $n$  is large and  $np > 5$  and  $nq > 5$ ,  
 $X \sim N(n, p) \approx N(np, npq)$

$\therefore P(Y < 40) = P(Y < 39.5)$  by Continuity Correction

$$= 0.24062$$

$$\approx 0.241(3\text{sig.fig})$$

Approximating a discrete distribution with a continuous distribution by Continuity Correction:



## 10. Topic: Hypothesis Testing

Let the random variable  $X$  be the mass of a components (in grams), and  $\mu$  the mean mass, where  $X \sim N(15, 1.2^2)$ .

For a random sample of 80 components,  $\bar{X} \sim N\left(15, \frac{1.2^2}{80}\right)$

To test  $H_0: \mu = 15$  against

$H_1: \mu \neq 15$  at 5% of significance

Testing for change in  $\mu \Rightarrow$  Two-tailed test

Reject  $H_0$  if  $p$ -value  $< 0.05$ .

Applying  $z$ -test with  $\bar{x} = 15.25$ ,  $n = 80$ ,  $\sigma = 1.2$  using G. C. (refer to Appendix for detailed steps),

```
Z-Test
Inpt: Data Stats
μ0: 15
σ: 1.2
x: 15.25
n: 80
μ: F00 < μ0 > μ0
Calculate Draw
```

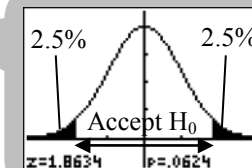
```
Z-Test
μ ≠ 15
z = 1.863389981
P = 0.062407292
x = 15.25
n = 80
```

**TI-84 Plus**

```
1-Sample ZTest
Data: Variable
μ0: #μ0
σ: 1.2
x: 15.25
n: 80
List Var
```

```
1-Sample ZTest
μ: #15
z = 1.86338998
P = 0.06240741
x = 15.25
n = 80
```

**fx-9860G**

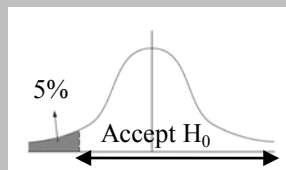


From GC, the  $p$ -value =  $0.0624 > 0.05$ , we do not reject  $H_0$ .

Hence, there is insufficient evidence at the 5% significance level to conclude that the mean mass of the components is not 15 grams.

Under  $H_0$ ,  $\bar{X} \sim N\left(15, \frac{1.2^2}{80}\right)$   
 To test  $H_0: \mu = 15$  against  
 $H_1: \mu < 15$  at 5% of significance  
 Reject  $H_0$  if  $z$ -value  $< z_{0.05}$ .

Testing for decrease in  $\mu$   
 i.e.  $H_1: \mu < 15$ , the critical  
 region is in the lower tail of the  
 distribution  $\Rightarrow$  left-tailed test



To obtain  $z_{0.05}$ , the critical value of  $z$  at 5%,  
 Using G. C. (refer to Appendix for detailed steps),

```
invNorm(.05,0,1)
-1.644853626
```

**TI-84 Plus**

```
Inverse Normal
Tail :Left
Area :0.05
σ :1
μ :0
Save Res:None
Execute
I/O
```

```
Inverse Normal
x=-1.6448536
```

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$$z_{0.05} = -1.64485$$

For  $H_0$  to be rejected at 5% level of significance, test statistic

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} = \frac{\bar{x} - 15}{\frac{1.2}{\sqrt{80}}} < z_{0.05}$$

$$\frac{\bar{x} - 15}{\frac{1.2}{\sqrt{80}}} < -1.645$$

$$\bar{x} < 14.779$$

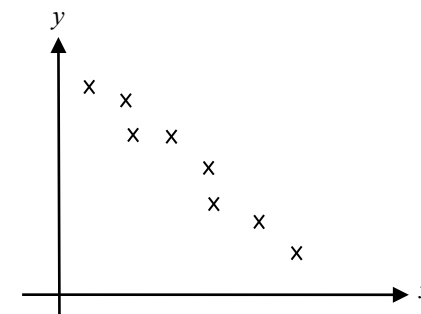
$$\bar{x} < 14.8 \text{ grams}$$

$\therefore$  Set of values:  $\{\bar{x} \in \mathbb{R}^+ : \bar{x} < 14.78\}$

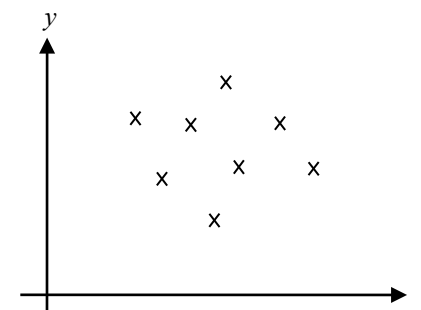
Note: Final answer expressed in  
 set notation as question asks for  
set of values.

## 11. Topic: Correlation and Regression

- (a) (i) Product moment correlation  
 coefficient  $\approx 0$   
 $\Rightarrow$  the eight points are  
 randomly distributed  
 with little or no pattern.



- (ii) Product moment correlation  
 coefficient  $\approx -0.8$   
 $\Rightarrow$  the eight points lie  
 moderately close to a  
 straight line with negative  
 gradient.



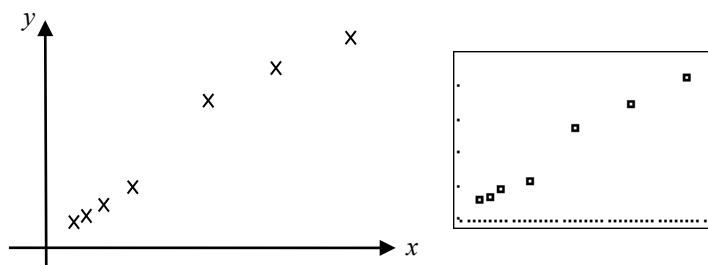
- (b) (i) Using G. C. (refer to Appendix for detailed steps),

L1	L2	L3	Z
18	2.85		
20	2.85		
22	2.85		
27	3.15		
L2(1)=2.55			

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List 1	List 2	List 3	List 4
18	2.55		
20	2.65		
22	2.85		
27	3.15		

**fx-9860G**



(ii) Using G. C. (refer to Appendix for detailed steps),

```
LinReg
y=ax+b
a=.1069341463
b=.5615170732
r=.9872953317
```

**TI-84 Plus**

```
LinearReg
a=.10693414
b=.56151707
r=.98729533
r2=.97475207
MSe=.06939212
y=ax+b
```

**fx-9860G**

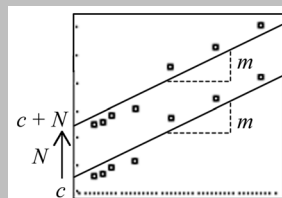
$$r = 0.98729 \approx 0.987 \text{ (3 sig.fig)}$$

(iii) Sub values of  $a$  and  $b$  obtained by G.C. in part (ii) into  $m$  and  $c$  respectively  $\Rightarrow y = 0.1069x + 0.5615$

(iv) When  $x = 40$ ,  $y = 0.1069(40) + 0.5615 = 4.8375 \approx 4.84$  (3 sig. fig.)  
 $\therefore$  **Estimated monthly earnings of a 40-year-old worker is \$4840.**

Since  $x = 40$  is within the range of given data values [18, 55], the estimate is reliable as we are interpolating within the data range.

(v)  $m$  will remain the same and the constant  $c$  becomes  $(c + N)$ .



Note:  $y$  is in thousand dollars!

Remember to square the standard deviations when calculating the variance!

## 12. Topic: Normal Distribution

(i) Let  $U$  be the random variable for the mass of an unwrapped sweet, where  $U \sim N(40, 3^2)$

Using G. C. (refer to Appendix for steps to access the normal distribution functions),

```
normalcdf(-E99,3
6,40,3)
.0912112819
```

**TI-84 Plus**

```
Normal C.D
Lower : -1E+99
Upper : 36
σ : 3
μ : 40
Save Res:None
Execute
```

**fx-9860G**

```
Normal C.D
P = 0.09121121
z:Low = -3.333E+98
z:Up = -1.3333333
```

$$P(U < 36) = 0.091211 \approx 0.0912 \text{ (3 sig.fig)}$$

(ii) Let  $W$  be the random variable for the mass of a wrapper, where  $W \sim N(4, 0.5^2)$

Let  $S$  be the random variable for the mass of a wrapped sweet.

$$\begin{aligned} E(S) &= E(U) + E(W) = 40 + 4 = 44 \\ \text{Var}(S) &= \text{Var}(U) + \text{Var}(W) = 3^2 + 0.5^2 = 9.25 \\ \therefore S &\sim N(44, 9.25) \end{aligned}$$

Using G. C. (refer to Appendix for steps to access the normal distribution functions),

```
normalcdf(42,46,
44,√(9.25))
.4892023398
```

**TI-84 Plus**

```
Normal C.D
Lower : 42
Upper : 46
σ : 3.04138126
μ : 44
Save Res:None
Execute
```

**fx-9860G**

```
Normal C.D
P = 0.48920222
z:Low = -0.6575959
z:Up = 0.65759594
```

$$P(42 < S < 46) = 0.48920 \approx 0.489 \text{ (3 sig.fig)}$$

If  $X \sim N(\mu_X, \sigma_X^2)$  and  $Y \sim N(\mu_Y, \sigma_Y^2)$  are two independent normal distributions,  
 $X \pm Y \sim N(\mu_X \pm \mu_Y, \sigma_X^2 + \sigma_Y^2)$



- (iii) Let  $C$  be the random variable for the mass of an empty cardboard tube, where  $C \sim N(50, 5^2)$ .

Let  $T$  be the random variable for the total mass of a tube containing 12 wrapped sweets.

$$\begin{aligned} T &= S_1 + S_2 + \dots + S_{12} + C \\ E(T) &= E(S_1 + S_2 + \dots + S_{12}) + E(C) \\ &= 12E(S) + E(C) \\ &= 12 \times 44 + 50 = 578 \\ \text{Var}(T) &= \text{Var}(S_1 + S_2 + \dots + S_{12}) + \text{Var}(C) \\ &= 12\text{Var}(S) + \text{Var}(C) \\ &= 12 \times 9.25 + 5^2 = 136 \end{aligned}$$

$$T \sim N(578, 136)$$

Using G. C. (refer to Appendix for steps to access the normal distribution functions),

```
normalcdf(600, E9
9.578, f(136))
.0296147861
```

**TI-84 Plus**

```
Normal C.D
Lower :600
Upper :1E+99
σ :11.6619037
μ :578
Save Res:None
Execute
None [LIST]
```

**fx-9860G**

If  $X_1, X_2, X_3, \dots, X_n$  are  $n$  independent observations of the normal variable  $X$  where  $X \sim N(\mu, \sigma^2)$ ,  
 $X_1 + X_2 + X_3 + \dots + X_n \sim N(n\mu, n\sigma^2)$   
 N.B.  $n$  is NOT squared for the variance! This is different from  $nX \sim N(n\mu, n^2\sigma^2)$ !

$$\therefore P(T > 600) = 0.029614 \approx \mathbf{0.0296 \text{ (3 sig.fig)}}$$

- (iv) Let  $Y$  be the random variable for the total mass of a tube containing 12 wrapped sweets produced by the rival company, where  $Y \sim N(\mu, \sigma^2)$ .

$$\text{Given } P(Y < 450) = 0.05 \quad \text{and} \quad P(Y > 550) = 0.08$$

$$P\left(Z < \frac{450 - \mu}{\sigma}\right) = 0.05 \quad P\left(Z > \frac{550 - \mu}{\sigma}\right) = 0.08$$

Using G. C. (refer to Appendix for detailed steps),

```
invNorm(0.05)
-1.644853626
```

**TI-84 Plus**

```
invNorm(0.92)
1.405071561
```

**TI-84 Plus**

```
Inverse Normal
Tail :Left
Area :0.05
σ :1
μ :0
Save Res:None
Execute
ICALC
```

**fx-9860G**

```
Inverse Normal
x=-1.6448536
```

```
Inverse Normal
Tail :Right
Area :0.08
σ :1
μ :0
Save Res:None
Execute
ICALC
```

**fx-9860G**

```
Inverse Normal
x=1.40507156
```

$$\frac{450 - \mu}{\sigma} = -1.64485$$

$$\mu = 450 + 1.64485\sigma \dots (1)$$

$$\frac{550 - \mu}{\sigma} = 1.40507$$

$$550 - \mu = 1.40507\sigma \dots (2)$$

$$\text{Sub (1) into (2): } 550 - 450 - 1.64485\sigma = 1.40507\sigma$$

$$\sigma = 32.7877 \Rightarrow \sigma^2 = 1075.0 \approx 1080$$

$$\Rightarrow \mu = 503.9309 \approx 504$$

$\therefore$  Mean  $\approx 504$  and variance  $\approx 1080$  (3 sig.fig)

## Appendix: Detailed G. C. Steps (for those still trapped in G. C. limbo)

Q3 (i), 5 (ii): Graph Sketching

**TI-84 Plus**

**MODE**

→ Ensure G. C. is in **FUNC** mode.

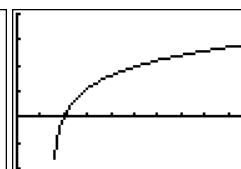
```
NORMAL SCI ENG
FLOAT 0 1 2 3 4 5 6 7 8 9
RADIAN DEGREE
FUNC PAR POL SEQ
CONNECTED DOT
SEQUENTIAL SIMUL
REAL a+bi P<°0i
FULL HORIZ G-T
SETCLOCK 08/16/11 7:50PM
```

**Y=** **WINDOW** **GRAPH**

3(i)

```
Plot1 Plot2 Plot3
Y1=ln(2X-3)
Y2=
Y3=
Y4=
Y5=
Y6=
Y7=
```

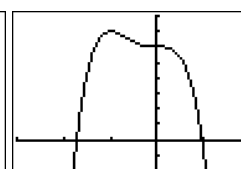
```
WINDOW
Xmin=0
Xmax=10
Xscl=1
Ymin=-2
Ymax=4
Yscl=1
Xres=1
```



5(ii)

```
Plot1 Plot2 Plot3
Y1=6-4X^3-3X^4
Y2=
Y3=
Y4=
Y5=
Y6=
```

```
WINDOW
Xmin=-3
Xmax=2
Xscl=1
Ymin=-2
Ymax=8
Yscl=1
Xres=1
```



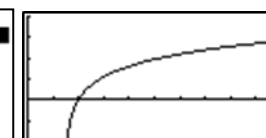
**fx-9860G**



3(i)

```
Graph Func :Y=
Y1=ln(2X-3)
Y2=
Y3=
Y4=
Y5=
Y6=
[SEL] [DEL] [TYPE] [STYL] [XMEM] [DRAW]
```

```
View Window
Xmin : 0
max : 10
scale:1
dot : 0.07936507
Ymin : -2
max : 4
[INIT] [TRIG] [STD] [STO] [RCL]
```



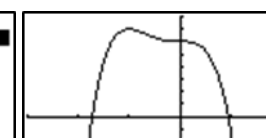
[SHIFT] ↑

[EXIT] [F6]

5(ii)

```
Graph Func :Y=
Y1=6-4X^3-3X^4
Y2=
Y3=
Y4=
Y5=
Y6=
[SEL] [DEL] [TYPE] [STYL] [XMEM] [DRAW]
```

```
View Window
Xmin : -3
max : 2
scale:1
dot : 0.03968253
Ymin : -2
max : 8
[INIT] [TRIG] [STD] [STO] [RCL]
```



[SHIFT] ↑

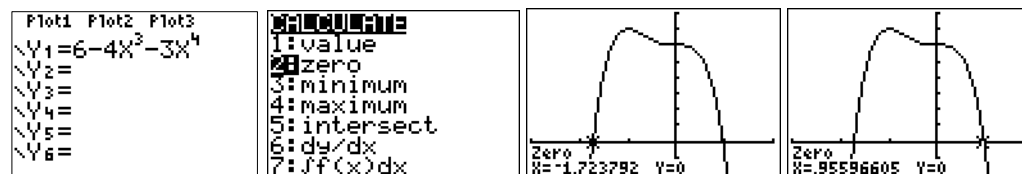
[EXIT] [F6]

Q5 (iii): Finding the Roots of a Function

**TI-84 Plus Method I: Using Zero Values of Graphs**

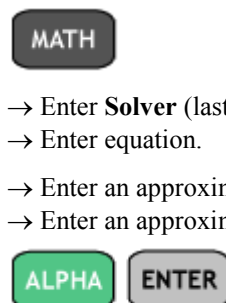


- Define approximate left/right bounds of value for 1<sup>st</sup> root.
- Repeat steps for 2<sup>nd</sup> root.

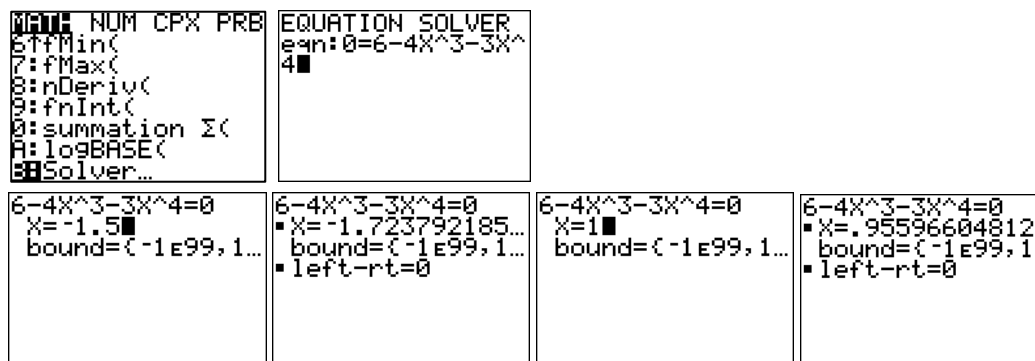


Note: This is the preferred method for Q5(iii) since we are already in Graphing mode having just sketched  $C$  in part (ii).

**Method II: Using Solver**



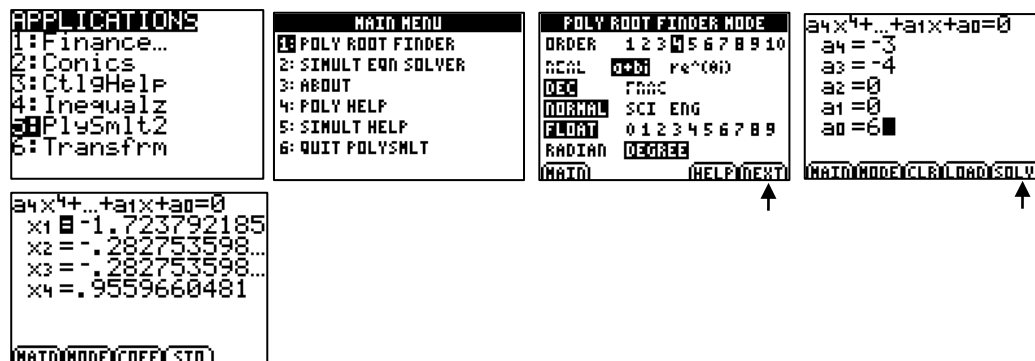
- Enter **Solver** (last item on MATH menu)
- Enter equation.
- Enter an approximate value of  $x$  (i.e.  $x = -1.5$ ) for 1<sup>st</sup> root.
- Enter an approximate value of  $x$  (i.e.  $x = 1$ ) for 2<sup>nd</sup> root.



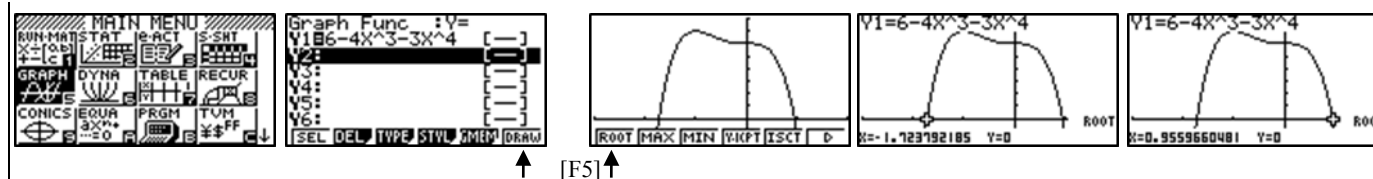
**Method III: Using Poly Root Finder Application**



- Enter **PlySmlt2**



**fx-9860G Find Roots in Graph**



**Q9 (i): Binomial Distribution (Computing Probability)**

**TI-84 Plus**

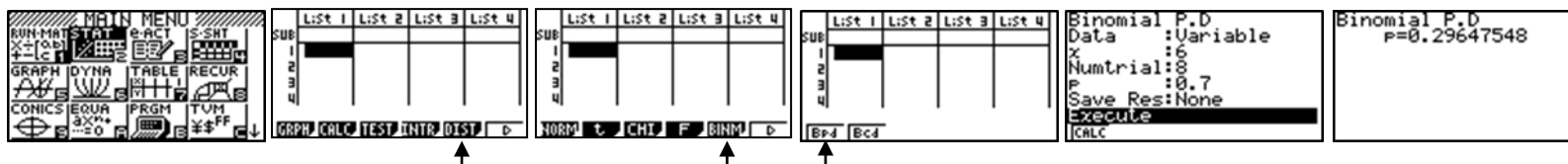


→ Key in the parameters.

```

DRAW
binompdf(8,0.7,6)
.29647548
    
```

**fx-9860G**



**Q9 (ii): Binomial Distribution (Computing Cumulative Probability)**

**TI-84 Plus**

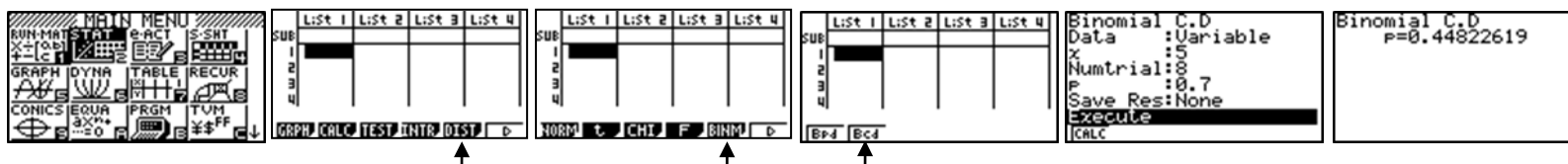


→ Key in the parameters.

```

DRAW
binomcdf(8,0.7,5)
.4482261914
    
```

**fx-9860G**



**Q9, Q12(i), (ii), (iii): Normal Distribution**

**TI-84 Plus**

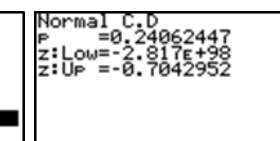
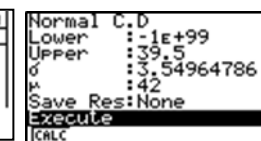
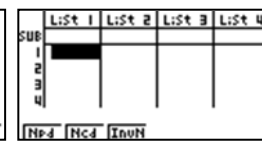
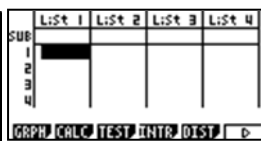


→ Key in the relevant parameters. Results shown are for Q9

```
0.0512 DRAW
1:normalcdf(
2:normalcdf(
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
```

```
normalcdf(-E99,3
9.5,42,√(12.6)
.2406243994
```

**fx-9860G**



**Q10, Q12 (iv): Finding z-value**

**TI-84 Plus**



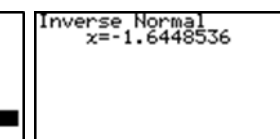
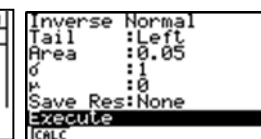
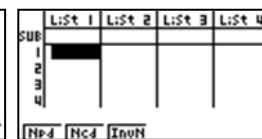
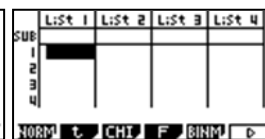
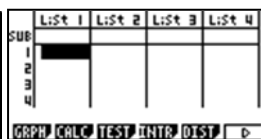
→ Key in the desired probability /level of significance. Results shown are for Q10

```
0.0512 DRAW
1:normalcdf(
2:normalcdf(
3:invNorm(
4:invT(
5:tpdf(
6:tcdf(
7:χ²pdf(
```

```
invNorm
area:0.05
μ:0
σ:1
Paste
```

```
invNorm(.05,0,1)
-1.644853626
```

**fx-9860G**



**Q10: Hypothesis Testing (z-Test with Data Summary)**

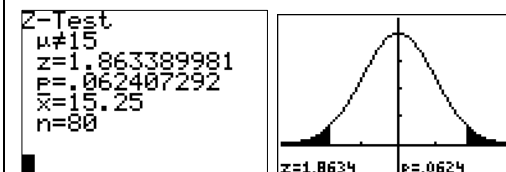
**TI-84 Plus**



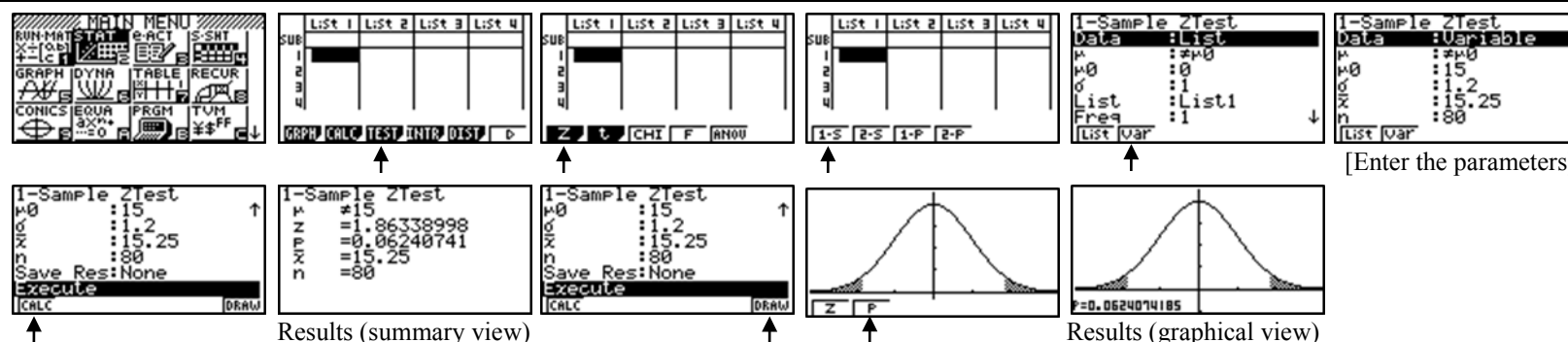
- Select **Stats** input method.
- Enter the population/sample mean,  $\sqrt{(\text{variance})}$ , sample size.
- Select  $\mu: \neq \mu_0$  for two-tailed test.



- Select **Calculate** for results in summary view.
- Select **Draw** for results in graphical view.



**fx-9860G**



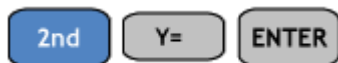
**Q11 (b)(i): Plotting Scatter Diagram**

**TI-84 Plus**



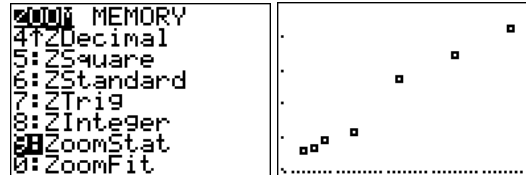
→ Enter xandy values in L1 and L2 respectively

2001 CALC TESTS	L1	L2	L3
1:Edit...	18	2.55	-----
2:SortA(	20	2.65	
3:SortD(	22	2.85	
4:ClrList	27	3.15	
5:SetUpEditor	35	4.76	
	45	5.45	
	55	6.26	
	L2(1)=2.55		

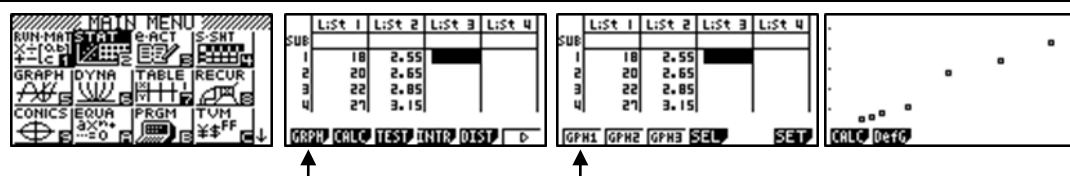


→ Turn On Plot1

2001 PLOT1 1:Plot1...Off L1 L2 2:Plot2...Off L1 L2 3:Plot3...Off L1 L2 4↓PlotsOff	2001 Plot1 Plot2 Plot3 0 Off Type: [Scatter] [Line] [Line of Best Fit] Xlist: L1 Ylist: L2 Mark: [Square]
--	--



**fx-9860G**





**Q11 (b)(ii): Finding Correlation Coefficient**

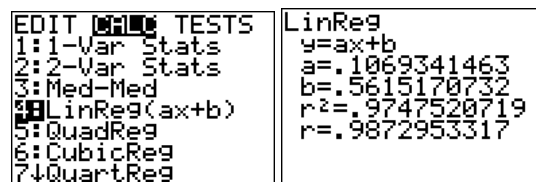
**TI-84 Plus**



Note: The  $r$  value will not appear if you miss this step!



Note: L1 contains the values of  $x$  (independent variable) and L2 the values of  $y$  (dependent variable) as populated in 11(b)(i).



**fx-9860G**

