# USING STATISTICAL FUNCTIONS ON A SCIENTIFIC CALCULATOR

**Objective:**

1. Improve calculator skills needed in a multiple choice statistical examination where the exam allows the student to use a scientific calculator.

2. Helps students identify where and what their problem may be.

**Target group:** This worksheet is for students who do not have a sound mathematical background and are doing a statistics module; students who did maths literacy at school; students who have a supplementary for a statistics exam.

<table>
<thead>
<tr>
<th>FUNCTION (normal mode)</th>
<th>CASIO fx-991ES PLUS</th>
<th>SHARP EL-532WH</th>
<th>MY NOTES FROM QL WORKSHOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper fractions $\frac{1}{4}$</td>
<td>$1 \div 4 = 1 \div 4$</td>
<td>$\frac{a}{b}c \div c = 1 \div 4$</td>
<td>(the answer is $1 \frac{1}{4}$)</td>
</tr>
<tr>
<td>Improper fractions $\frac{10}{3}$</td>
<td>$10 \div 3 = 3 \div 1 \div 3$</td>
<td>$\frac{a}{b}c \div c = 3 \div 1 \div 3$</td>
<td></td>
</tr>
<tr>
<td>Mixed fractions $4 \frac{1}{3}$</td>
<td>$4 \div 1 \div 3 = 4 \div 1 \div 3$</td>
<td>$\frac{a}{b}c \div c = 4 \div 1 \div 3$</td>
<td>$\frac{a}{b}c \div c = 13 \div 3$</td>
</tr>
<tr>
<td>Converting between fractions and decimals</td>
<td>Follows from above</td>
<td>Follows from above</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$13 \div 3 \div c \text{ answer } 4.333$</td>
<td>$13 \div 3 \div c \text{ answer } 4.333$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$4.333 \div c \text{ answer } 4 \div 1 \div 3$</td>
<td>$4.333 \div c \text{ answer } 4 \div 1 \div 3$</td>
<td></td>
</tr>
</tbody>
</table>
Having difficulty simplifying $\frac{4}{12}$ without the use of a calculator? Did you know it is much quicker to do it mentally than reach for a calculator?! Try doing a worksheet or QL workshop on "FRACTIONS"

<table>
<thead>
<tr>
<th>n! $\leftrightarrow$ n factorial</th>
<th>$n! = n \times (n-1) \times \cdots \times 2 \times 1$</th>
<th>5! = $5 \times 4 \times 3 \times 2 \times 1$</th>
<th>The factorial notation is used to represent the product of the first $n$ natural numbers, where $n \in \mathbb{N}_0$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fractions using $n! \div n!$</td>
<td>$\frac{5!}{3!}$</td>
<td>$5! \div 3! = 20$</td>
<td>$5 \text{ SHIFT } x^{-1} = 120$</td>
</tr>
<tr>
<td>Fractions with two factorials in the denominator</td>
<td>$\frac{10!}{7!3!}$</td>
<td>$\frac{10!}{7!3!} \times 3 \text{ SHIFT } x^{-1} = 120$</td>
<td>$5 \text{ 2ndF } 4 = 120$</td>
</tr>
</tbody>
</table>

The button with orange SHIFT above it engages the orange colour stats functions above each numerical pad button.

The orange 2ndF button engages the orange colour stats functions in the left hand corner of each numerical pad button.

Permutations $\leftrightarrow nPr$ (no repeats; order is important)

$$nPr = \frac{n!}{(n-r)!}$$

$$9P6 = \frac{9!}{(9-6)!}$$

Before pushing equal the screen will have $9P6$.

Else

$$9 \text{ 2ndF } 6 = 60480$$

After pushing equal the screen will have $9P6$.

Else

$$9 \text{ 2ndF } 5 \text{ 6} = 60480$$

Combinations $\leftrightarrow nCr$ (no repeats; order is NOT important)

$$nCr = \frac{n!}{r!(n-r)!}$$

$$9C6 = \frac{9!}{6!(9-6)!}$$

Before pushing equal the screen will have $9C6$.

Else

$$9 \text{ 2ndF } 5 = 84$$

After pushing equal the screen will have $9C6$.

Else

$$9 \text{ 2ndF } 5 \text{ 6} = 84$$
$nCr = \frac{n!}{r!(n-r)!}$

$9C6 = \frac{9!}{6!(9-6)!}$

Both sets of brackets NB! Why?

Counting $r$ objects in $n$ different ways $\Leftrightarrow \ n^r$

(repeats/repetition) $5^6$

$5 \times 6 = 15625$

Exponents in a bracket

$0.75^{(9-6)}$

$0.75^{(9-6)} \times 2$

Powers with base $e$ $\Leftrightarrow e^x$

$\frac{1}{e^3}$

0.75 \times \left[ 9 - 6 \right] = 0.422

The calculator already opens with a bracket, it just needs to be closed. Why and when?

You get the answer without closing the bracket, BUT what would happen if you multiplied the expression by 2?

$0.75 \times \left[ 9 - 6 \right] \times 2 = 0.844$

Now closing the bracket is important. Why?

Alternatively, $1 \times 3 \times 3 = 1.396$

Alternatively, $1 \times a \times b \times c = 1.396$

See diagram 1 for determining the differences between **PERMUTATIONS & COMBINATIONS**.

(Appendix A attached at the end of this QL worksheet)
### Quantitative Literacy (QL)

**UNISA**

**Durban Learning Centre, 221 Dr Pixley Ka Seme St**

### Shift Key

- **$e^{-3}$**
  
  1. $\ln 1 ÷ 3 \] = 1.396
  
  2. $\ln (-) 3 \] = 0.05
  
  **The calculator automatically puts brackets around the first term. Why is there no need to put brackets in this situation?**

  1. $\ln 1 ÷ 3 \] = 0.05
  
  Alternatively,

  1. $\ln 3 \] = 0.05
  
  **Note:** $\frac{1}{e^3} = e^{-3}$. Why?

  **But:** $e^3 \neq e^{-3}$.

  1. $(-) 4 \times \ln 2 ÷ 3 \] = -2.054
  
  Alternatively replace $÷$ with $\div$.

- **$\frac{1}{e^3}$**

  1. $\ln 3 \] = 0.05
  
  Alternatively,

  1. $\ln 3 \] = 0.05
  
  **Note:** $\frac{1}{e^3} = e^{-3}$. Why?

  **But:** $e^3 \neq e^{-3}$.

  1. $(-) 4 \times \ln 2 ÷ 3 \] = -2.054
  
  Alternatively replace $÷$ with $\div$.

- **$-4e^{-\frac{2}{3}}$**

  1. $\ln 2 ÷ 3 \] = 2.45
  
  The calculator automatically puts brackets around the first term.

  **Brackets are not required**.

---

**Discrete probability distributions** make use of the universal constant $e$. Try a worksheet or QL workshop on 

**“DISCRETE PROBABILITY DISTRIBUTION FUNCTIONS”**

**Square root**

$\sqrt{x}$

**When to use brackets**

- **$\sqrt{6}$**

  1. $\sqrt{6} \] = 2.45

  The calculator automatically puts brackets around the first term.

  **Brackets are not required**.
| Two terms under the square root sign | \( \sqrt{64 - 20} \) | puts brackets around the first term. | \[ \sqrt{64 - 20} = 6.63 \] |
| Square root as a denominator | \( \frac{1}{\sqrt{6}} \) | When there is one term brackets are not necessary. Why? | \( \sqrt{6} = 2.45 \) |
| Square root as a fraction in the denominator, where \( \sqrt{\cdot} \) is in the numerator | \( \frac{1}{\sqrt{6}} \) | \[ 1 \div \frac{\sqrt{6}}{6} = 0.41 \] | \[ 1 \div \sqrt{6} = 0.41 \] |

When there is one term, brackets are not necessary. Why?

\[ \sqrt{6} = 2.45 \]

Why?

Leaving out the closing brackets gives the same answer.

Why the emphasis on brackets?????

\[ \sqrt{[64 - 20]} = 6.63 \]

Can you see why brackets are important in this situation?

\[ \frac{1}{\sqrt{6}} \div 2 = 3.32 \]

The brackets tell the square root sign what needs to be beneath the square root.

\[ 1 \div \sqrt{[6]} = 0.82 \]

The outer red bolded set of brackets (arrows above) is
<table>
<thead>
<tr>
<th>Mathematical Expression</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{1}{\sqrt{6}} )</td>
<td>Square root as a fraction in the denominator, where ( \sqrt{ } ) is in the denominator of the fraction ( \frac{1}{\frac{3.5}{\sqrt{10}}} ).</td>
</tr>
<tr>
<td>( \frac{1}{3.5} )</td>
<td>Denominator having a square root with two terms ( \frac{6}{\sqrt{24 - 12}} ).</td>
</tr>
<tr>
<td>( 7.3 - 3.5 )</td>
<td>Brackets required above and below ( \frac{3.5}{\sqrt{10}} ).</td>
</tr>
</tbody>
</table>

The calculator always opens the square root sign. In this situation it is not essential to close bracket but it creates a habit. To get into the habit of putting brackets at the top of a division line and at the bottom. Why?

\[ \frac{6}{\sqrt{24 - 12}} = 1.73 \]

Alternatively replace \( \div \) with \( \frac{}{} \). It is essential to open with a bracket under the square root sign. In this situation it is not essential to close bracket but it creates a habit.

\[ \frac{7.3 - 3.5}{\frac{3.5}{\sqrt{10}}} = 3.433 \]

"necessary. (a must!) The inner is not (see \( \sqrt{6} \) above). Why?"

\[ 1 \div \left[ \frac{3.5}{\sqrt{10}} \right] = 0.9035 \]

Alternatively,

\[ 1 \div 3.5 \left( \frac{a}{b} \sqrt{10} \right) = 0.9035 \]

Using the function \( \frac{a}{b} \sqrt{c} \) means that there is no need for the fraction to go into brackets. Yes you can use \( \frac{a}{b} \) for both \( \div \) but lower one requires brackets. Why?

\[ 6 \div \left( \frac{7.3 - 3.5}{\frac{3.5}{\sqrt{10}}} \right) = 3.433 \]

Get into the habit of putting brackets at the top of a division line and at the bottom. Why?
The calculator opened the bracket beneath the square root sign, hence the double closed bracket before the equal sign. The bottom brackets can be removed ONLY if the fraction function \( \frac{a}{b/c} \) is used to replace the second division sign. Try this!

The bottom brackets can be removed ONLY if the fraction function \( \frac{a}{b/c} \) to replace the second division sign. Try this!

Having difficulty answering all or some of the ‘why?’ above ..... try a worksheet or QL workshop on “ORDER OF OPERATION (BODMAS)”

percentage sign \( \Rightarrow \% \)
converting from 67% to a probability

\[
\begin{align*}
67 & \text{SHIFT}[1] = 0.67 \\
67 & \text{2ndF}[1] = \text{ERROR 1}
\end{align*}
\]

Begin by doing \( 6 \times 1 = 67 \) now \( \text{2ndF}[1] = 0.67 \)

Why does this work? The calculator requires an ANS then the \( \text{2ndF}[1] = 0.67 \)

Having difficulty doing the above without a calculator, then try a worksheet or QL workshop on “PERCENTAGES”

The next sections deal with using the MODE function on a scientific calculator.

\[
\begin{align*}
\text{ONE variable of data} & \Rightarrow x \\
\text{ENTER Data for } x & : \\
\text{MODE} & \\
\text{Choose option } 3: \text{STAT} \text{ by pushing the keypad for } 3 \\
\text{Choose option } 1: 1-\text{VAR} \text{ by pushing the keypad for } 1
\end{align*}
\]
<table>
<thead>
<tr>
<th>RACT</th>
<th>16; 15; 24; 7; 21; 34</th>
<th>Pushing the keypad for 1. Enter the data as follows: 16 = 15= 24= 7= 21= 34= using the toggle button. Move the cursor up to the last value, i.e. 34 on the screen then push AC.</th>
<th>Choose option SD by pushing the keypad for 0. Notice the following on the screen Stat 0. Enter the data as follows: 16M+ 15M+ 24M+ 7M+ 9 M+ 21M+ 34M+. Notice the screen says DATA SET= 7. There are 7 values in the dataset.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SUM</strong> of $\sum_{x}$</td>
<td>$\sum_{x}$</td>
<td>$\sum_{x}$</td>
<td>$\sum_{x}$</td>
</tr>
<tr>
<td>$\sum x$</td>
<td>$\sum x$</td>
<td>$\sum x$</td>
<td>$\sum x$</td>
</tr>
<tr>
<td>$\sum x^2$</td>
<td>$\sum x^2$</td>
<td>$\sum x^2$</td>
<td>$\sum x^2$</td>
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<tr>
<td>$\sum x^2$</td>
<td>$\sum x^2$</td>
<td>$\sum x^2$</td>
<td>$\sum x^2$</td>
</tr>
<tr>
<td><strong>Combining sum and variable functions</strong></td>
<td><strong>Combining sum and variable functions</strong></td>
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<td><strong>Combining sum and variable functions</strong></td>
</tr>
<tr>
<td>$\frac{\sum_{x}}{n}$</td>
<td>$\frac{\sum_{x}}{n}$</td>
<td>$\frac{\sum_{x}}{n}$</td>
<td>$\frac{\sum_{x}}{n}$</td>
</tr>
<tr>
<td><strong>SHIFT</strong> 1</td>
<td><strong>SHIFT</strong> 1</td>
<td><strong>SHIFT</strong> 1</td>
<td><strong>SHIFT</strong> 1</td>
</tr>
<tr>
<td><strong>STAT</strong> 33</td>
<td><strong>STAT</strong> 33</td>
<td><strong>STAT</strong> 33</td>
<td><strong>STAT</strong> 33</td>
</tr>
<tr>
<td><strong>SUM</strong> 2</td>
<td><strong>SUM</strong> 2</td>
<td><strong>SUM</strong> 2</td>
<td><strong>SUM</strong> 2</td>
</tr>
<tr>
<td>126</td>
<td>2784</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td><strong>SHIFT</strong> 1</td>
<td><strong>SHIFT</strong> 1</td>
<td><strong>SHIFT</strong> 1</td>
<td><strong>SHIFT</strong> 1</td>
</tr>
<tr>
<td><strong>4VAR</strong> 1</td>
<td><strong>4VAR</strong> 1</td>
<td><strong>4VAR</strong> 1</td>
<td><strong>4VAR</strong> 1</td>
</tr>
<tr>
<td>$\sum_{x}$</td>
<td>$\sum_{x}$</td>
<td>$\sum_{x}$</td>
<td>$\sum_{x}$</td>
</tr>
<tr>
<td><strong>ALPHA</strong> $\bullet$ = 126</td>
<td><strong>ALPHA</strong> $\bullet$ $\sum_{x}$</td>
<td>18</td>
<td><strong>ALPHA</strong> $\bullet$ $\sum_{x}$</td>
</tr>
<tr>
<td><strong>ALPHA</strong> $\bullet$ $\sum_{x}$</td>
<td>18</td>
<td><strong>ALPHA</strong> $\bullet$ $\sum_{x}$</td>
<td><strong>ALPHA</strong> $\bullet$ $\sum_{x}$</td>
</tr>
<tr>
<td>The ALPHA or the RCL button engages the teal colour stats functions in the right hand corner of each numerical pad button.</td>
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</tr>
</tbody>
</table>
Before beginning such a problem, insert the brackets

\[ \sqrt{ \frac{\sum x^2 - \frac{\sum x^2}{n}}{n-1} } \]

Brackets inserted: underneath the square root sign; at the top (numerator) and the bottom (denominator) of a fraction.

\[ \sqrt{ \frac{\sum x^2 - \frac{\sum x^2}{n}}{n-1} } \]

Brackets inserted: underneath the square root sign; at the top (numerator) and the bottom (denominator) of a fraction.

See the importance of brackets? Brackets create steps.

\[ \text{SIZE sample } \leftrightarrow n \]

Sample MEAN \( \leftrightarrow \bar{x} \)
Sample STD DEVIATION

\[ \Rightarrow s_x \]

\[ \text{SHIFT} \quad 1 \quad 4 \quad 4 \quad s_x \]

= 9.274

Option \( 3: \sigma_x \) is for the POPULATION standard deviation. What is the difference between a sample and population standard deviation?

\[ \text{SHIFT} \quad 1 \quad 4 \quad 4 \quad \sigma_x \]

\[ s_x^2 = 86 \]

Notice that when using the calculator, the sample standard deviation is obtained first, squaring the value gives the sample variance.

\[ \text{standard deviation}^2 = \text{variance} \]

\[ \text{ALPHA} \quad \frac{s_x}{5} = 9.274 \]

\[ \text{ALPHA} \quad \frac{s_x}{6} \] is for the POPULATION standard deviation. What is the difference between a sample and population standard deviation?

\[ \text{ALPHA} \quad \frac{x}{5} \quad \frac{x^2}{5} = 86 \]

Notice that when using the calculator, the sample standard deviation is obtained first, squaring the value gives the sample variance.

\[ \text{standard deviation}^2 = \text{variance} \]

It is one thing to learn to use a calculator, but a sound understanding of Descriptive Statistics is needed.

Try do worksheets or QL workshops on the following: “DESCRIPTIVE STATISTICS”

ONE variable of data using FREQUENCY option

Example: pdf of a discrete random variable

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P(x) )</td>
<td>0.25</td>
<td>0.4</td>
<td>0.2</td>
<td>0.15</td>
</tr>
</tbody>
</table>

[SHIFT] [MODE] toggle down using

\[ \Delta \quad \text{REPLAY} \]

\[ \text{Frequency?} \]

\[ \frac{4}{4-\text{STAT}} \quad \frac{1}{1-\text{ON}} \]

[MODE]

Choose option \[ \frac{1}{\text{STAT}} \] by pushing the keypad for \( 1 \)

Choose option \[ \frac{0}{\text{SD}} \] by pushing the keypad for \( 0 \)

Notice the following on the screen \( \text{Stat 0} \)

Enter the data as follows:

\( 0 = 1= 2= 3= \)

Enter the data as follows:
The expected value of $x$

Then toggle to the top where $x$ is 0

then move to the freq column using the right arrow on the replay button.

$0.25 = 0.4 = 0.2 = 0.15$ = using the toggle button move the cursor up to the last line where $x=3$ and freq=0.15 on the screen then push AC

$x$ in this situation is the variables and freq is the probability of $x$, i.e. $P_x$.

$\text{SHIFT} \ 1 \ \text{STAT} \ 4 \ \text{VAR} \ \frac{2}{\pi}$

$= 1.25$

$\text{SHIFT} \ 1 \ \text{STAT} \ 4 \ \text{VAR} \ 3 \ \text{VAR}$

$= 0.9937$

Notice that

$\text{SHIFT} \ 1 \ \text{STAT} \ 4 \ \text{VAR} \ 4 = \text{ERROR}$

In this situation the \textit{POPULATION standard deviation} is used. Why?

$\text{ALPHA} \ \frac{x}{4} = 1.25$

$\text{ALPHA} \ 6 = 0.9937$

Notice that

$\text{ALPHA} \ \frac{\sigma_x}{4} = \text{ERROR}$.

In this situation the \textit{POPULATION standard deviation} is used. Why?

$\text{ALPHA} \ \frac{\sigma_x}{6} = 0.9875$

The $\text{ALPHA}$ or the \textit{RCL} button engages the teal colour stats functions in the right hand corner of each numerical pad button.

The standard deviation of $x$

The variance of $x$

$\text{SHIFT} \ \frac{4}{\pi}$

$x^2 \ = 0.9875$

standard deviation $^2$ = variance

Remove frequency from the screen:

$0 \ \text{STO} \ 0.25 \ \text{M+}$

$1 \ \text{STO} \ 0.4 \ \text{M+}$

$2 \ \text{STO} \ 0.2 \ \text{M+}$

$3 \ \text{STO} \ 0.15 \ \text{M+}$

Notice the screen says

DATA SET = 4

There are 4 values in the dataset.

$x$ in this situation is the variables and $y$ is the probability of $x$, i.e. $P_x$.

$\text{ALPHA} \ \frac{x}{2} = 0.9937$
It is not sufficient to learn only the calculator version. Do a worksheet or QL workshop on “DISCRETE PROBABILITY DISTRIBUTION FUNCTIONS”

**TWO variables of data**

\( x, y \)

For example:

2.6 5.6
2.6 5.1
3.2 5.4
3.0 5.0
2.4 4.0
3.7 5.0
3.7 5.2

**Enter the data as follows:**

2.6 = 2.6 = 3.2 = 3.0 = 2.4 =
3.7 = 3.7 =

Then toggle to the top

x equal to 2.6
then move to the freq column.

5.6 = 5.1 = 5.4 = 5.0 = 4.0 =
5.0 = 5.2 =

using the toggle button move the cursor up to the last line where x=3.7 and y=5.2 on the screen then push AC

Make sure that the variable x is entered underneath the x column and the y variable underneath the y column.

**Choose option** by pushing the keypad for 1

**Choose option** by pushing the keypad for 1

Notice the following on the screen Stat 1

Enter the data as follows:

*Always the x variable first, then the y variable. NB!!*

2.6 STO 5.6 M+
2.6 STO 5.1 M+
3.2 STO 5.4 M+
3.0 STO 5.0 M+
2.4 STO 4.0 M+
3.7 STO 5.0 M+
3.7 STO 5.2 M+
Notice that \( a + bx \) is the mathematical equation for a straight line.

Notice the screen says DATA SET= 7

There are 7 paired values in the dataset.

| **SIZE** sample \( \Leftrightarrow n \) | \( \text{SHIFT} \quad \frac{1}{4} \frac{4}{1} \frac{1}{n} \) | \( n \) |
| Sample MEAN \( \Leftrightarrow \bar{x} \) | \( \text{SHIFT} \quad \frac{1}{4} \frac{4}{2} \) | \( \bar{x} \) |
| Sample \( \text{STD DEVIATION} \) \( \Leftrightarrow s_x \) | \( \text{SHIFT} \quad \frac{1}{4} \frac{4}{4} \) | \( s_x \) |
| \( \bar{y} \) | \( \text{SHIFT} \quad \frac{1}{4} \frac{4}{5} \) | \( \bar{y} \) |
| \( s_y \) | \( \text{SHIFT} \quad \frac{1}{4} \frac{4}{7} \) | \( s_y \) |

The ALPHA or the RCL button engages the teal colour stats functions in the right hand corner of each numerical pad button.

Use either the teal ALPHA button or the RCL button to recall the information

\[ \sum x = 21.2 \]
The ALPHA or the RCL button engages the teal colour stats functions in the right hand corner of each numerical pad button.

**Regression coefficients**

\[ \hat{y} = b_0 + b_1 x \]

- Intercept: \( b_0 = \alpha \)
- Slope: \( b_1 = \beta \)
- Correlation coefficient: \( r \)

**On calculator**

\[ \begin{align*}
\text{Intercept: } & b_0 = \alpha \\
\text{Slope: } & b_1 = \beta \\
\text{Correlation coefficient: } & r
\end{align*} \]

**Example**

- Intercept: \( b_0 = 4.093 \)
- Slope: \( b_1 = 0.314 \)
- Correlation coefficient: \( r = 0.327 \)
**Slope** \( b_1 = b \)

**Coefficient of Determination:** \( r^2 \)

\[
\text{SHIFT} \quad \frac{1}{\text{STAT}} \quad \frac{5}{\text{Reg}} \quad \frac{3}{3r} \quad x^2 = 0.107
\]

**Estimated value of** \( y \) **i.e.** \( \hat{y} \)

when \( x = 3.1 \):

\[
\text{SHIFT} \quad \frac{1}{\text{STAT}} \quad \frac{5}{\text{Reg}} \quad \frac{1}{\text{Lg}} \\
+ \quad \text{SHIFT} \quad \frac{1}{\text{STAT}} \\
\frac{5}{\text{Reg}} \quad \frac{2}{2B} \times 3.1 \\
= 5.065
\]

Alternatively,

\[
3.1 \quad \text{SHIFT} \quad \frac{1}{\text{STAT}} \\
\frac{5}{\text{Reg}} \quad \frac{5}{5\hat{y}} = 5.065
\]

**Coefficient of Determination:** \( r^2 \)

\[
\text{ALPHA} \quad \frac{r}{\chi^2} = 0.107
\]

**Estimated value of** \( y \) **i.e.** \( \hat{y} \)

when \( x = 3.1 \):

\[
\text{ALPHA} \left( \frac{a}{b} + \right) \\
\text{ALPHA} \quad \times \\
3.1 = 5.065
\]

Alternatively,

\[
3.1 \quad 2ndF \quad \frac{\hat{y}}{\hat{y}} = 5.065
\]

The above section requires a sound understanding of correlation and simple regression. Try a worksheet or a QL workshop on “CORRELATION AND SIMPLE REGRESSION”.

Contact acalit@unisa.ac.za or a Quantitative Literacy Facilitator in your region.
Appendix A:

Note that $nCr \leq nPr$. Why?

$$combination = \frac{n!}{r!(n-r)!}$$

$$\Rightarrow combination = \frac{n!}{r!(n-r)!} = \frac{1}{r!}permutation$$

$$\therefore permutation = r!combination$$

So there will be $r!$ permutations for every possible combination.

**Diagram 1: Counting: Permutations and Combinations**