

# STATS 10x learning resource: Diagnostic Quiz practice examples and notes [DQ]

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## STATS 10x Workshops

The Statistics Department offers workshops and one-to-one/small group assistance for STATS 10x students wanting to improve their statistics skills and understanding of core concepts and topics.

Leila's website for STATS 10x workshop hand-outs and information is here: [www.tinyURL.com/stats-10x](http://www.tinyURL.com/stats-10x)

Resources for this hand-out, including pdfs of this hand-out and Leila's scanned slides showing her working for each problem are available here: [www.tinyURL.com/stats-DQ](http://www.tinyURL.com/stats-DQ)

**Want to get in touch with Leila?**

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## Why do I need basic maths and calculator skills for Statistics?

Statistics is about summarising, analysing and communicating information. An important part of summarising and analysing information involves having basic numerical literacy skills and doing basic mathematical calculations.

Don't feel you have to do these calculations using mental arithmetic! You can use a calculator to do most of the work for you, but you will need to understand the order of operations for mathematical calculations and be able to apply these rules on your calculator.

### Why use a calculator and not a computer?

You won't get access to a computer in your test and exam! However, we do need to check you understand how various formulae should be applied to problems in the test and exam, so you will need to be able to use your calculator to do these.

### This stuff is not just useful for Statistics!

You should find these basic maths and calculator skills helpful in your everyday life when you consume numerical information via media reports or the internet. You need to be numerically literate to make informed decisions day-to-day, for example about your personal health or finances, or making judgments about current political issues.

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## A note about rounding numbers

Often students ask me about rounding numbers – how to do it and how much by.

When you do a calculation, you may end up with an answer that has many (5 or more) decimal places associated with it. People don't deal too well with numbers to this level of accuracy; rounding helps us make a number a little simpler while still keeping its value relatively close to what it was. The result is less accurate, but easier to use, interpret and understand.

### How to round numbers

- Decide which is the last digit to keep
- Leave it the same if the next digit is less than 5 (this is called **rounding down**)
- Increase it by 1 if the next digit is 5 or more (this is called **rounding up**)

### How many decimal places should I use?

When you are doing calculations in an assignment or test/exam context, you should get some guidance from the question itself. For example, a multi-choice test question may have five answers that are all rounded to one decimal place (1dp for short) so just round your answer when you do the calculation to 1dp.

If you are going to use the value you come up with in a later calculation, go for more accuracy rather than less, as the more you round a number, the more it will affect the results of later calculations that use that value. My default amount of rounding tends to be 4dp – this is reasonably accurate without going over the top!

### Exercise 1 – Rounding

1. Write 12.34567 to:

- (a) 4dp                      (b) 3dp                      (c) 2dp                      (d) 1dp

2. Write 35.999 to:

- (a) 2dp                      (b) 1dp

3. Write 987.65432 to:

- (a) 4dp                      (b) 3dp                      (c) 2dp                      (d) 1dp

## Calculating proportions – *useful practice for Diagnostic Quiz: Question 1*

### Proportions and Proportional Reasoning

A **proportion** is a number between 0 and 1 that quantifies uncertainty.

There are two main sources of proportions:

1. Proportions using a model – some models that may involve equally likely outcomes are *tossing a coin, rolling a die* and *drawing a card from a deck*. You may have met these examples at school.
2. Proportions from data

In STATS 10x, we are usually going to be using the second source: data.

Some terminology you may find useful includes:

- An **event** is a collection of outcomes. An event **occurs** if any outcome making up that event occurs.
- We sometimes label events, for example, let  $A$  be the event that ... occurs.
- To calculate the proportion for an event,  $A$ , use this formula:

$$\text{pr}(A) = \frac{\text{number of outcomes in } A}{\text{total number of outcomes}}$$

Let's do some examples using some real data!

A hot topic in New Zealand over 2015 and 2016 was the possibility of changing our flag. There was an online process where anyone could submit a design for consideration; 10,008 designs were submitted by midnight on Thursday, 16 July 2015. A silver fern featured in 2,195 of the designs. What proportion of the flag designs submitted feature a silver fern?

Using the formula above, where  $SF$  is the event that a submitted flag design features a silver fern, we get the following:

$$\text{pr}(SF) = \frac{2,195}{10,008} = 0.2193 \text{ (4dp)}$$

Of the 10,008 designs submitted, 4,057 featured the Southern Cross. The proportion of the flag designs featuring the Southern Cross is:

Using the formula above, where  $SC$  is the event that a submitted flag design features the Southern Cross, we get the following:

$$\text{pr}(SC) = \frac{4,057}{10,008} = 0.4054 \text{ (4dp)}$$

## Exercise 2 – Calculating proportions

The NZ Herald often runs what it calls DigiPolls – these are surveys of random samples of New Zealanders about various issues throughout the year. In August 2014, the NZ Herald surveyed 750 randomly selected New Zealanders about lifestyle and found the following information:

- One of the questions asked where the person would live if they had a choice of anywhere in the world. Here are some of the answers to this question:
  - 495 people would choose to live in NZ.
  - 83 people would choose to live in Australia.
  - 81 people would choose to live in Europe.
  - 12 people would choose to live in Asia.
- 50 of the respondents were of Asian ethnicity.

Using this information from the DigiPoll, answer the following questions (give your answers to three decimal places):

1. What proportion of people in the sample would choose to live in **NZ** if they had a choice of anywhere in the world?
2. What proportion of people in the sample would choose to live in **Australia** if they had a choice of anywhere in the world?
3. What proportion of people in the sample would choose to live in **Europe** if they had a choice of anywhere in the world?
4. What proportion of people in the sample would choose to live in **Asia** if they had a choice of anywhere in the world?
5. What proportion of respondents were of **Asian ethnicity**?

## Calculation skills – useful practice for Diagnostic Quiz: Question 2

### Worked examples

Get confident using your calculator by working through the following examples:

1.  $8.67 + 5.1$   
 $8.67 \boxed{+} 5.1 \boxed{=} \quad 13.77$

2.  $6.1 + 3.2 \times 2.65$   
 $6.1 \boxed{+} 3.2 \boxed{\times} 2.65 \boxed{=} \quad 14.58$

3.  $8 \times 2 + 16 \div 4$   
 $8 \boxed{\times} 2 \boxed{+} 16 \boxed{\div} 4 \boxed{=} \quad 20$

4.  $7 - 5 + 2 \times 1 - 4$   
 $7 \boxed{-} 5 \boxed{+} 2 \boxed{\times} 1 \boxed{-} 4 \boxed{=} \quad 0$

5.  $5 + \frac{1}{2} \text{ of } 6$   
 $5 \boxed{+} 1 \boxed{\div} 2 \boxed{\times} 6 \boxed{=} \quad 8$

6.  $7 + 6 \div 2 \times 3$   
 $7 \boxed{+} 6 \boxed{\div} 2 \boxed{\times} 3 \boxed{=} \quad 16$

7.  $4 \times 3 + 7 \div 2 + 30$   
 $4 \boxed{\times} 3 \boxed{+} 7 \boxed{\div} 2 \boxed{+} 30 \boxed{=} \quad 45.5$

Do some of these answers seem strange to you? If so, it's because of the **order of operations**, which is built into your calculator.

## Order of Operations

In Mathematics we carry out operations such as  $+$ ,  $-$ ,  $\times$  and  $\div$  on numbers.

When each of these operations is carried out on numbers, the order of operations in mathematics is:

### Step 1: Brackets

If there is more than one set of brackets, work from the innermost one outwards.

### Step 2: Exponents

This is when a number is to "the power of" another number. This includes squaring, square rooting, etc.

### Step 3: Division or Multiplication

These operations are tied and are therefore done at the same time, working from left to right.

### Step 4: Addition and Subtraction

These operations are also tied and done at the same time, working from left to right.

For example, to calculate this example (Question 3 from page 8) by hand:

$$8 \times 2 + 16 \div 4$$

carry out the multiplication and division (working left to right) before doing the addition:

$$= (8 \times 2) + 16 \div 4 \quad \text{(multiplication is first, working left to right)}$$

$$= 16 + 16 \div 4 \quad \text{(division is next)}$$

$$= 16 + (16 \div 4) \quad \text{(division before addition)}$$

$$= 16 + 4 \quad \text{(addition is last)}$$

$$= 20 \quad \text{(final answer!)}$$

For example, to calculate this example (Question 4 from page 8) by hand:

$$7 - 5 + 2 \times 1 - 4$$

carry out the multiplication before doing the subtraction, addition and subtraction, working left to right:

$$= 7 - 5 + (2 \times 1) - 4 \quad (\text{multiplication is first})$$

$$= 7 - 5 + 2 - 4 \quad (\text{subtraction, addition and subtraction are done working left to right})$$

$$= (7 - 5) + 2 - 4$$

$$= 2 + 2 - 4$$

$$= (2 + 2) - 4$$

$$= 4 - 4$$

$$= 0$$

Doing these calculations by hand is a lot of work!

Luckily the order of operations is built into your calculator so all you have to do is type the problem into the calculator exactly as it is written on the page and then it will do all of this work for you...

Hopefully you're feeling more confident at using your calculator now.

If you need some more practice, work through the following exercise:

### **Exercise 3 – Practice your calculation skills using your calculator**

Round your answers to 4dp if necessary.

(a)  $4.2 \times 3.8 =$

(e)  $4.6 + 5.2 \times 3 =$

(b)  $1.2 + 5.78 =$

(f)  $45.3 - 21.7 \div 0.72 =$

(c)  $12.2 - 5.3 =$

(g)  $26.3 \times 2.8 \times 4.9 - 3.75 =$

(d)  $-1.2 + 6.9 =$

(h)  $1.2 + 6.92 =$

## Fractions, decimals and percentages – *useful practice for Diagnostic Quiz: Questions 3 and 4*

### Useful tips and tricks

When dealing with fractions, decimals and percentages, there are a few things you need to keep in mind:

- 'Per cent' means one out of a hundred. We use **percentages** to describe parts of a whole – the whole being made up of a hundred equal parts. Percentages are used frequently in all walks of life.  
*For example: 10% off all shoes*
- Decimals are usually numbers that use a decimal point followed by digits that show a value smaller than one. We can also use **proportion** for decimals between 0 and 1.  
*For example: 0.1*
- **Decimals** and **percentages** are just different numerical representations of the same value. I find it much easier to understand the value out of 100 compared to the same value out of 1 so I prefer percentages to decimals. However, you will need to be comfortable switching between these two numerical representations!
  - To convert from **decimal** to **percentage**, you **multiply** by 100%.  
*For example:  $0.1 \times 100\% = 10\%$*
  - To convert from **percentage** to **decimal**, you **divide** by 100%.  
*For example:  $10\% \div 100\% = 0.1$*
- Note that  $1 = 100\%$  - they are just different representations of the same value!
- When you are asked to find something "of" something else, you are being asked to **multiply** the two numbers together.  
*For example:  $\frac{1}{2}$  of 4 =  $\frac{1}{2} \times 4 = 2$*
- When you are asked to find a percentage of something, you must convert the percentage to a decimal, that is, you need to divide the percentage by 100% before doing the multiplication indicated by the "of".
- When doing fractions on your calculator, you can choose to use the fraction button, or just read the horizontal bar of the fraction as "divided by" ( $\div$ ).
- When you are dealing with decimals, you can end up with quite small numbers. Your calculator may deal with these by presenting them as



## Calculating percentage change – useful practice for Diagnostic Quiz: Question 5

### Why do we calculate percentage change?

Percentage change is all about comparing an old (initial) value to a new (final) value. It quantifies the change from the initial number to the final number and expresses the change as an increase or decrease in percentage terms. You will get a negative percentage change when your final value is smaller than your initial value (i.e. a decrease), while you will get a positive percentage change when your final value is larger than your initial value (i.e. an increase).

### Percentage change formula

When comparing your old value to your new value, subtract the old from the new, then divide by the old value. This gives you a proportion or decimal representation so show it as a percentage by multiplying by 100%.

$$\text{Percent Change} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100\%$$

### Percentage change example

In October 2011 recorded crime statistics for the year ending 30 June 2011 were released. Table 1 shows the number of reported offences by category for the years ending 30 June 2010 and 30 June 2011, obtained from the Statistics New Zealand website.

Type of offence	2009/10	2010/11	% Change
Homicide	122	93	-23.8
Acts intended to cause injury	45350	43594	-3.9
Sexual assault	2961	3327	12.4
Dangerous or negligent acts endangering persons	772	905	17.2
Abduction and harassment	14514	13748	-5.3
Robbery and extortion	2785	2503	-10.2
Unlawful entry with intent/burglary	60142	59361	-1.3
Theft	141357	136524	-3.4
Fraud and deception	10989	8953	-18.5
Illicit drug offences	24580	20973	-14.7
Weapons and explosives offences	7427	6612	-11.0
Property damage and environmental pollution	61675	55531	++
Public order offences	47363	44290	-6.5
Offences against justice procedures	20515	18561	-9.5
Miscellaneous offences	1408	1349	-4.2

**Table 1:** Crimes by offence type

Note that one of the values for **% Change** has been replaced with ++. (See the **Property damage and environmental pollution** row). You will calculate this out as Exercise 5 below, but before you do that, let's use this table to illustrate the formula being applied appropriately.

Firstly, take note of the positive and negative values in the **% Change** column. Note that most of the rows show negative values for **% Change** (Rows 1, 2, 5, 6, 7, 8, 9, 10, 11, 13, 14 and 15). Only **Sexual assault** and **Dangerous or negligent acts endangering persons** show positive values for **% Change**. This is because these two rows (Rows 3 and 4) have larger values in the **2010/11** (new) column compared to the **2009/10** (old) column.

**Question:** Do you think the **Property damage and environmental pollution** row will have a positive or a negative **% Change**?

Let's replicate the first row (**Homicide**) **% Change** calculation:

$$\text{Percent Change} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100\%$$

$$\text{Percent Change} = \frac{93 - 122}{122} \times 100\% = \frac{-29}{122} \times 100\% = -23.7705\% \quad (4\text{dp})$$

Round -23.7705% to 1dp and you get **-23.8%** for the **Homicide % Change**.

Now let's replicate the third row (**Sexual assault**) **% Change** calculation:

$$\text{Percent Change} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} \times 100\%$$

$$\text{Percent Change} = \frac{3327 - 2961}{2961} \times 100\% = \frac{366}{2961} \times 100\% = 12.3607\% \quad (4\text{dp})$$

Round 12.3607% to 1dp and you get **12.4%** for the **Sexual assault % Change**.

### Exercise 5 – Percentage change

In Table 1 above, the value of '% Change' from 2009/10 to 2010/11 for **Property damage and environmental pollution** is missing. To one decimal place, this value is:

- |     |        |     |        |
|-----|--------|-----|--------|
| (1) | -11.1% | (4) | -10.0% |
| (2) | 11.1%  | (5) | 9.0%   |
| (3) | 10.0%  |     |        |

## Straight line equations – useful practice for *Diagnostic Quiz: Questions 6, 7 & 8*

### Linear equations

A linear equation describes a straight line. The straight line is drawn on a graph with an x-axis and a y-axis that cross at right angles.

The x-axis line on a graph runs horizontally (left-right) through zero.

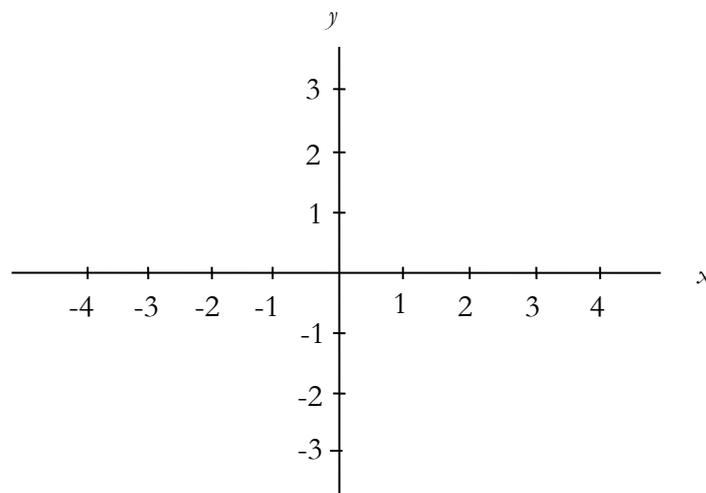
The y-axis line on a graph runs vertically (up-down) through zero.

The straight line is used as a reference line so you can measure from it.

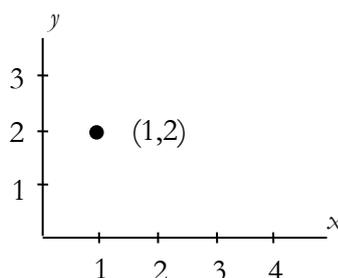
### Plotting coordinates (points)

A coordinate (point on a graph) is a set of values that show an exact position. On graphs it is common to have a pair of numbers to show where a point is: the first number shows the distance along (in the x-direction) and the second number shows the distance up or down (in the y-direction).

We can represent coordinates (points) on a pair of axes. The figure below shows the (horizontal) x-axis, and the (vertical) y-axis.

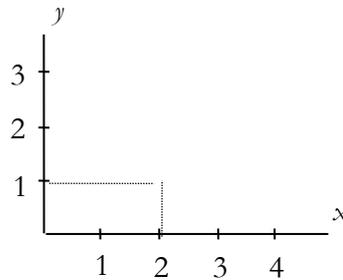


The point represented below is (1,2); that is, it has an x-coordinate, or position, of 1 and a y-coordinate, or position, of 2.



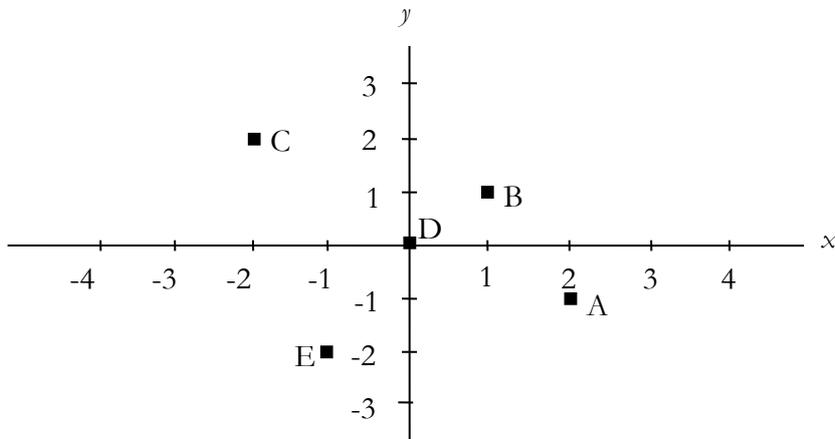
Now, let's try plotting the point  $(2,1)$ , i.e.  $x = 2, y = 1$ , on a pair of axes.

To do this we go 2 units along the  $x$ -axis and draw an imaginary vertical line. Then we go one unit up the  $y$ -axis and draw an imaginary horizontal line. At the intersection of the two lines is the required point (coordinate).



### Exercise 6 – Labelling coordinates

Write down the coordinates of the labelled points.



A =

B =

C =

D =

E =

## Lines

A straight line can be described as an equation of the form:

$$y = mx + c$$

where  $m$  and  $c$  are constants, that is, fixed values.

This formula may also be written as:

$$y = c + mx$$

as the order of the two parts of the formula ( $c$  and  $mx$ ) doesn't matter.

Every equation of this form can be graphed as a straight line.

Here are some examples of linear equations which describe straight lines:

1.  $y = 2x - 1$

3.  $y = 2 - 9x$

2.  $y = 2x + 1$

4.  $y = 1 + 2x$

Notice that  $y = 2x + 1$  (equation 2) is exactly the same as  $y = 1 + 2x$  (equation 4) because the order of the two parts of the formula is interchangeable.

### Exercise 7 – Identifying $c$ and $m$ from a given linear equation formula

For each of these formulae, identify which is  $c$ , the constant or number by itself, and which is  $m$ , the constant or number associated with (or right next to)  $x$ :

1.  $y = 2x + 1$                        $c =$                        $m =$

2.  $y = 2 - 9x$                        $c =$                        $m =$

3.  $y = 2x - 1$                        $c =$                        $m =$

4.  $y = 1 + 2x$                        $c =$                        $m =$

## The $y$ -intercept and slope of a straight line

It turns out that  $c$  and  $m$  are particular attributes of a straight line.

$c$ , the constant by itself, describes where the line cuts the (vertical)  $y$ -axis. This is called the line's  **$y$ -intercept**.

$m$ , the constant or number associated with (or right next to)  $x$ , describes the "steepness" or slope of the line. This is called the line's **slope** or **gradient**.

**Example:** Consider this line:  $y = 2 - 3x$

- What is the line's  **$y$ -intercept**?

The  **$y$ -intercept** is 2.

- What is the line's **slope** or **gradient**?

The **slope (gradient)** is -3.

**Example:** Consider this line:  $y = 3x + 1$

- What is the line's  **$y$ -intercept**?

The  **$y$ -intercept** is 1.

- What is the line's **slope** or **gradient**?

The **slope (gradient)** is 3.

## Exercise 8 – Working with linear equations

For each line, state the  **$y$ -intercept** and the **slope (gradient)**.

1.	$y = 1 - 3x$	$y$ -intercept =	slope (gradient) =
2.	$y = 3x + 1$	$y$ -intercept =	slope (gradient) =
3.	$y = -7 - 3x$	$y$ -intercept =	slope (gradient) =
4.	$y = 3x - 7$	$y$ -intercept =	slope (gradient) =
5.	$y = 7 + 5x$	$y$ -intercept =	slope (gradient) =

6. State the equation of a line which has a  $y$ -intercept of 7 and a gradient -3.
7. Find the equations of the following lines:
- the gradient is -4 and the  $y$ -intercept is 2
  - the line has the same slope as (is parallel to)  $y = 3x - 2$  and has a  $y$ -intercept of 5

### Using the line to work out $y$ for a particular value of $x$

Our straight line equations are very useful for working out what  $y$  is for a particular value of  $x$ . All we need to do is substitute our value of  $x$  into the formula and use our calculator to work out what  $y$  will be.

**Example:** Consider this line:  $y = 5x + 4$

- What is the value of  $y$  if  $x$  is 2?

$$y = 5x + 4 \text{ so if } x \text{ is } 2 \text{ then } y = 5 \times 2 + 4 = 14$$

- If  $x$  is 5, what is the value of  $y$ ?

$$y = 5x + 4 \text{ so if } x \text{ is } 5 \text{ then } y = 5 \times 5 + 4 = 29$$

**Example:** Consider this line:  $y = 2 - 3x$

- What is the value of  $y$  if  $x$  is 2?

$$y = 2 - 3x \text{ so if } x \text{ is } 2 \text{ then } y = 2 - 3 \times 2 = -4$$

- If  $x$  is 5, what is the value of  $y$ ?

$$y = 2 - 3x \text{ so if } x \text{ is } 5 \text{ then } y = 2 - 3 \times 5 = -13$$

### Exercise 9 – What is $y$ for a particular value of $x$ ?

1.	$y = 1 - 3x$	If $x$ is 1, what is $y$ ?
2.	$y = 3x + 1$	What is the value of $y$ if $x$ is 2?
3.	$y = -3x - 7$	If $x$ is 3, what is $y$ ?
4.	$y = 3x - 7$	What is the value of $y$ if $x$ is 4?

### Using the line to work out how $y$ changes when $x$ increases

I like to think of the slope as the rise over the run, i.e. as the ratio  $\frac{\text{rise}}{\text{run}}$

The slope, or gradient, of the line tells us **how  $y$  changes**, when  **$x$  increases by a particular amount**. If  **$x$  increases by 1 unit**, then  **$y$  will change by whatever the slope value is**. If the slope is **positive**,  $y$  will **increase** by the slope value whereas if the slope is **negative**,  $y$  will **decrease** by the slope value. If  **$x$  increases by 2 units**, then  **$y$  will change by  $2 \times$  whatever the slope value is**, and so on.

**Example:** Consider this line:  $y = 3x + 1$ . The slope (gradient) is  $+3$ , therefore for every one unit increase in  $x$ ,  $y$  will increase by 3.

- How does  $y$  change when  $x$  increases by 2?

The slope (gradient) is 3 so if  $x$  increases by 2, then  $y$  will change by  $3 \times 2 = 6$ , that is,  $y$  will increase by 6.

- If  $x$  increases by 4 how does  $y$  change?

The slope (gradient) is 3 so if  $x$  increases by 4, then  $y$  will change by  $3 \times 4 = 12$ , that is,  $y$  will increase by 12.

**Example:** Consider this line:  $y = 2 - 3x$ . The slope (gradient) is  $-3$ , therefore for every one unit increase in  $x$ ,  $y$  will decrease by 3.

- How does  $y$  change when  $x$  increases by 3?

The slope (gradient) is  $-3$  so if  $x$  increases by 3, then  $y$  will change by  $-3 \times 3 = -9$ , that is,  $y$  will decrease by 9.

- If  $x$  increases by 5 how does  $y$  change?

The slope (gradient) is  $-3$  so if  $x$  increases by 5, then  $y$  will change by  $-3 \times 5 = -15$ , that is,  $y$  will decrease by 15.

### Exercise 10 – How does $y$ change given a particular increase in $x$ ?

For each line, state the change in  $y$  for the given increase in  $x$ .

1.	$y = 1 - 3x$	If $x$ increases by 1, then $y$ increases/decreases by?
2.	$y = 3x + 1$	If $x$ increases by 2, then $y$ increases/decreases by?
3.	$y = -3x - 7$	If $x$ increases by 3, then $y$ increases/decreases by?
4.	$y = 3x - 7$	If $x$ increases by 4, then $y$ increases/decreases by?

## Answers

### Exercise 1 – Rounding

- |                      |                    |                       |
|----------------------|--------------------|-----------------------|
| 1. (a) 12.3457 (4dp) | 2. (a) 36.00 (2dp) | 3. (a) 987.6543 (4dp) |
| (b) 12.346 (3dp)     | (b) 36.0 (1dp)     | (b) 987.654 (3dp)     |
| (c) 12.35 (2dp)      |                    | (c) 987.65 (2dp)      |
| (d) 12.3 (1dp)       |                    | (d) 987.7 (1dp)       |

### Exercise 2 – Calculating proportions

- |                |          |                |
|----------------|----------|----------------|
| 1. 0.66        | 3. 0.108 | 5. 0.067 (3dp) |
| 2. 0.111 (3dp) | 4. 0.016 |                |

### Exercise 3 – Practice your calculation skills using your calculator

- |           |         |                   |             |
|-----------|---------|-------------------|-------------|
| (a) 15.96 | (c) 6.9 | (e) 20.2          | (g) 357.086 |
| (b) 6.98  | (d) 5.7 | (f) 15.1611 (4dp) | (h) 8.12    |

### Exercise 4 – Fractions, decimals and percentages

- |                                  |           |            |
|----------------------------------|-----------|------------|
| 1. (a) 4                         | 3. (c) 1  | 4. (a) 34% |
| (b) $\frac{1}{6} = 0.1667$ (4dp) | (d) 0.05  | (b) 1.5%   |
| 2. (a) 40%                       | (e) 0.01  |            |
| (b) 0.4                          | (f) 0.035 |            |
| 3. (a) 0.5                       | (g) 0.1   |            |
| (b) $5 \times 10^{-3} = 0.005$   | (h) 0.25  |            |

### Percentage change example

**Answer:** I think the **Property damage and environmental pollution** row will have a negative % **Change**, because the (new) 2010/11 value (55531) is smaller than the (old) 2009/10 value (61675).

### Exercise 5 – Percentage change

The answer to the multi-choice question is (4).

### Exercise 6 – Labelling coordinates

A = (2, -1), B = (1, 1), C = (-2, 2), D = (0, 0), E = (-1, -2)

### Exercise 7 – Identifying $c$ and $m$ from a given linear equation formula

- |    |         |          |    |          |         |
|----|---------|----------|----|----------|---------|
| 1. | $c = 1$ | $m = 2$  | 3. | $c = -1$ | $m = 2$ |
| 2. | $c = 2$ | $m = -9$ | 4. | $c = 1$  | $m = 2$ |

Note that equations 1. and 4. are identical!

### Exercise 8 – Working with linear equations

1.	$y = 1 - 3x$	$y$ -intercept = 1	slope (gradient) = -3
2.	$y = 3x + 1$	$y$ -intercept = 1	slope (gradient) = 3
3.	$y = -7 - 3x$	$y$ -intercept = -7	slope (gradient) = -3
4.	$y = 3x - 7$	$y$ -intercept = -7	slope (gradient) = 3
5.	$y = 7 + 5x$	$y$ -intercept = 7	slope (gradient) = 5

6. You can do this in either order:  
 $y = mx + c$  where  $m = -3$  and  $c = 7$ ,  
 so the equation of the line is:  $y = -3x + 7$   
 OR  
 $y = c + mx$  where  $c = 7$  and  $m = -3$ ,  
 so the equation of the line is:  $y = 7 - 3x$
7. (a)  $y = -4x + 2$  (or  $y = 2 - 4x$ )  
 (b)  $y = 3x + 5$  (or  $y = 5 + 3x$ )

**Exercise 9 – What is  $y$  for a particular value of  $x$ ?**

1.  $y = -2$       2.  $y = 7$       3.  $y = -16$       4.  $y = 5$

**Exercise 10 – How does  $y$  change given a particular increase in  $x$ ?**

1.  $y$  decreases by 3      ( $-3 \times 1 = -3$ )      3.  $y$  decreases by 9      ( $-3 \times 3 = -9$ )  
2.  $y$  increases by 6      ( $3 \times 2 = 6$ )      4.  $y$  increases by 12      ( $3 \times 4 = 12$ )

## Want help with STATS 10x?

### Statistical help available from Leila Boyle

Each semester, Leila Boyle offers STATS 10x students help through a number of workshops. She also helps students (either one-to-one or with study groups of two or more people) by appointment.

### **STATS 10x appointments**

Book your preferred time with Leila here: [www.tinyurl.com/appt-stats](http://www.tinyurl.com/appt-stats), or contact her directly:

#### **Leila Boyle**

Undergraduate Statistics Assistance, Department of Statistics  
Room 303.322 (third floor of the Science Centre)  
[l.boyle@auckland.ac.nz](mailto:l.boyle@auckland.ac.nz); (09) 923-9045; 021 447-018

### **STATS 10x Workshops**

Workshops are run in a relaxed environment, and allow plenty of time for questions. In fact, this is encouraged 😊

Please make sure you bring your calculator with you to all of these workshops!

- **Preparation at the beginning of the semester:**

Multiple identical sessions of a preparation workshop are run at the beginning of the semester to get students off to a good start – come along to whichever one suits your schedule!

- Basic maths and calculator skills for Statistics

[www.tinyurl.com/stats-BM](http://www.tinyurl.com/stats-BM)

- **First half of the semester**

Five theory workshops are held during the first half of the semester:

- Exploratory Data Analysis [www.tinyURL.com/stats-EDA](http://www.tinyURL.com/stats-EDA)
- Proportions and Proportional Reasoning [www.tinyURL.com/stats-PPR](http://www.tinyURL.com/stats-PPR)
- Observational Studies, Experiments, Polls and Surveys  
[www.tinyURL.com/stats-OSE](http://www.tinyURL.com/stats-OSE)
- Confidence Intervals: *Proportions* [www.tinyURL.com/stats-CIP](http://www.tinyURL.com/stats-CIP)
- Confidence Intervals: *Means* [www.tinyURL.com/stats-CIM](http://www.tinyURL.com/stats-CIM)

**Useful Computer Resource:**

If you haven't used SPSS before, try working your way through this self-paced tutorial: [www.tinyURL.com/stats-IS](http://www.tinyURL.com/stats-IS)

**Second half of the semester**

Four theory workshops and one computing workshop are held during the second half of the semester:

- **Statistics Theory Workshops**

- Hypothesis Tests: *Proportions* [www.tinyURL.com/stats-HTP](http://www.tinyURL.com/stats-HTP)
- Hypothesis Tests: *Means* [www.tinyURL.com/stats-HTM](http://www.tinyURL.com/stats-HTM)
- Chi-Square Tests [www.tinyURL.com/stats-CST](http://www.tinyURL.com/stats-CST)
- Regression and Correlation [www.tinyURL.com/stats-RC](http://www.tinyURL.com/stats-RC)
- **Computer Workshop:** Hypothesis Tests *in SPSS*  
[www.tinyURL.com/stats-HTS](http://www.tinyURL.com/stats-HTS)

**You can register your interest in workshops here:**

[www.tinyURL.com/stats-EOI](http://www.tinyURL.com/stats-EOI)

**You can get email and/or text reminders or just show up!**

**Useful Websites**

- Canvas: <https://canvas.auckland.ac.nz>
- Leila's website for STATS 10x workshop hand-outs and information:  
[www.tinyURL.com/stats-10x](http://www.tinyURL.com/stats-10x)