ST. JEAN DE BREBEUF
MATHEMATICS

# CHAPTER 4.1

# STATISTICAL MEASURES

# CHAPTER 4.1 STATISTICAL MEASURES

**Per capita** represents the average amount or value per person, such as per capita income. Per capita figures are to make comparisons.

***EXAMPLE 1*** *Per Capita*

Many business, health and economics statistics are expressed as *per capita* figures. In March 2008, the national wealth of Canada was **$5 702 000 000 000**. The national debt was **$23 000 000 000.** The population of Canada was **33 223 840**.

(a) What was Canada's *per capita* ***wealth****?*

$$PER\,CAPITA\,WEALTH = \frac{NATIONAL\,WEALTH}{POPULATION}$$

$$PER\,CAPITA\,WEALTH = \frac{\$5\,702\,000\,000\,000}{33\,223\,840}$$

$$PER\,CAPITA\,WEALTH = \$171\,623.75$$

Canada's wealth is **$171 623.75** per capita (per person)

# CHAPTER 4.1 STATISTICAL MEASURES

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***EXAMPLE 1*** *Per Capita*

Many business, health and economics statistics are expressed as *per capita* figures. In March 2008, the national wealth of Canada was **$5 702 000 000 000**. The national debt was **$23 000 000 000.** The population of Canada was **33 223 840**.

(b) What was Canada's *per capita* ***debt****?*

$$PER\,CAPITA\,DEBT = \frac{NATIONAL\,DEBT}{POPULATION}$$

$$PER\,CAPITA\,DEBT = \frac{\$23\,000\,000\,000}{33\,223\,840}$$

$$PER\,CAPITA\,DEBT = \$692.27$$

Canada's debt is **$692.27** per capita (per person)

# CHAPTER 4.1 STATISTICAL MEASURES

**Per capita** represents the average amount or value per person, such as per capita income. Per capita figures are to make comparisons.

***EXAMPLE 1*** *Per Capita*

Many business, health and economics statistics are expressed as *per capita* figures. In March 2008, the national wealth of Canada was **$5 702 000 000 000**. The national debt was **$23 000 000 000.** The population of Canada was **33 223 840**.

(c) What was Canada's *per capita* ***net worth****?*

Canada's net worth is **$171 623.06** per capita (per person)

$$PER\,CAPITA\,NET\,WORTH = \frac{NATIONAL\,WEALTH - DEBT}{POPULATION}$$

$$PER\,CAPITA\,NET\,WORTH = \frac{\$5\,702\,000\,000\,000 - \$23\,000\,000\,000}{33\,223\,840}$$

$$PER\,CAPITA\,NET\,WORTH = \frac{\$5\,679\,000\,000\,000}{33\,223\,840}$$

$$PER\,CAPITA\,NET\,WORTH = \$171623.06$$

# CHAPTER 4.1 STATISTICAL MEASURES

**Percent change** shows the change in value *over time*

FORMULA: $$Percentchange = \frac{Newvalue - Old\ value}{Old\ value} \times 100$$

***EXAMPLE 2*** *Percent Change*

| YEAR | PROFIT ($) |
|---|---|
| 2005 | 186 000 |
| 2006 | 364 000 |
| 2007 | 728 000 |
| 2008 | 212 000 |
| 2009 | – 22 000 |

The table shows a company's profits each year for five years, as reported in a newspaper

(a) Calculate the percent change in profit from **2005 to 2006**

$$Percentchange = \frac{Newvalue - Old\ value}{Old\ value} \times 100$$

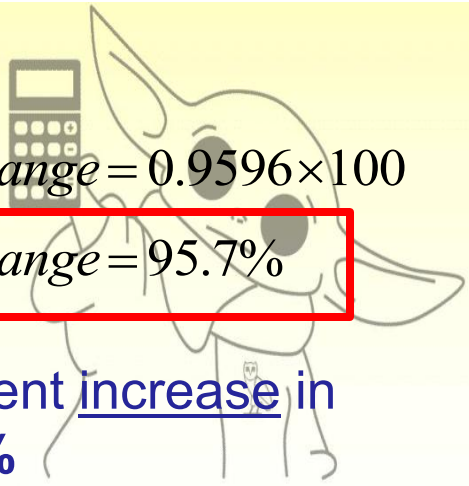
$$Percentchange = \frac{364000 - 186000}{186000} \times 100$$

$$Percentchange = \frac{178000}{186000} \times 100$$

$$Percentchange = 0.9596 \times 100$$

$$Percentchange = 95.7\%$$

There is a percent increase in profits by **95.7%**



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# CHAPTER 4.1 STATISTICAL MEASURES

**Percent change** shows the change in value *over time*

FORMULA: $$Percentchange = \frac{Newvalue - Old\ value}{Old\ value} \times 100$$

***EXAMPLE 2*** *Percent Change*

| YEAR | PROFIT ($) |
|---|---|
| 2005 | 186 000 |
| 2006 | 364 000 |
| 2007 | 728 000 |
| 2008 | 212 000 |
| 2009 | – 22 000 |

(b) Calculate the percent change in profit from **2008 to 2009**

$$Percentchange = \frac{Newvalue - Old\ value}{Old\ value} \times 100$$

$$Percentchange = \frac{-22000 - 212000}{212000} \times 100$$

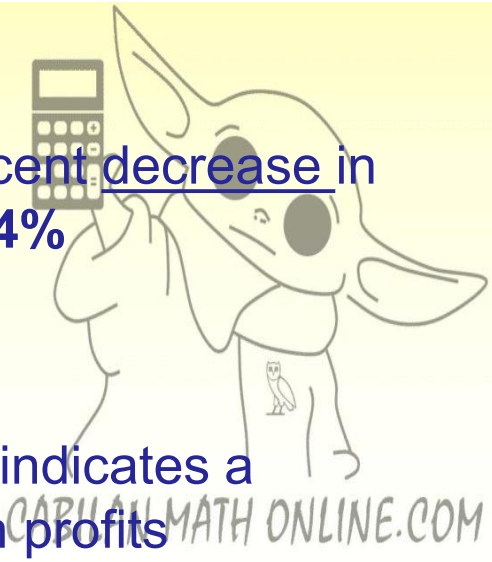
$$Percentchange = \frac{-234000}{212000} \times 100$$

$$Percentchange = -1.1038 \times 100$$

$$Percentchange = -110.4\%$$

There is a percent decrease in profits by **110.4%**

"–" percent change indicates a **decrease** or **loss** in profits



# CHAPTER 4.1 STATISTICAL MEASURES

**Percent change** shows the change in value *over time*

FORMULA: $$Percentchange = \frac{Newvalue - Old\ value}{Old\ value} \times 100$$

***EXAMPLE 2*** *Percent Change*

| YEAR | PROFIT ($) |
|---|---|
| 2005 | 186 000 |
| 2006 | 364 000 |
| 2007 | 728 000 |
| 2008 | 212 000 |
| 2009 | – 22 000 |

(c) The company claimed that "There was a **200% increase** in profits from 2006 to 2007". Is this statement true? Explain.

$$Percentchange = \frac{Newvalue - Old\ value}{Old\ value} \times 100$$

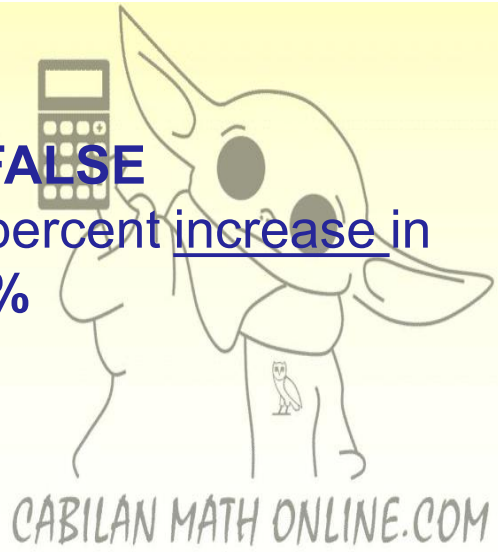
$$Percentchange = \frac{728\,000 - 364\,000}{364\,000} \times 100$$

$$Percentchange = \frac{364\,000}{364\,000} \times 100$$

$$Percentchange = 1 \times 100$$

$$\boxed{Percentchange = 100\%}$$

Statement is **FALSE**
→ There is a percent increase in profits by **100%**



# CHAPTER 4.1 STATISTICAL MEASURES

A **percentile rank** gives the percent of values *less than (L)* or *equal (E)* to a particular value. They usually rounded to the nearest whole number.

FORMULA:

$$Percentile(p) = \left( \frac{L + 0.5E}{n} \right) \times 100$$

where *n* represents the number of data

To find the position of a score with a specific *percentile*, use the formula ***p*** x ***n***

***EXAMPLE 3***

*Percentile and Percentile Rank*

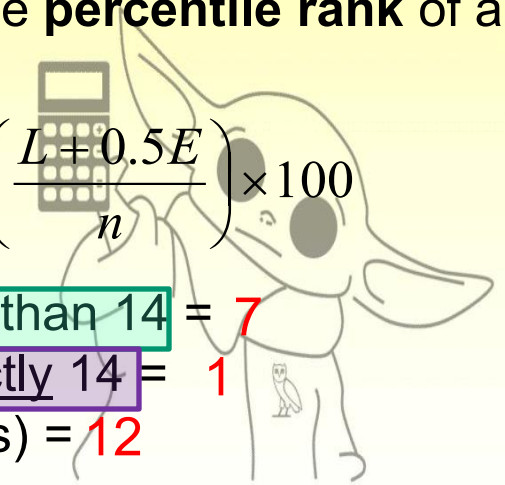
Below are the scores on a high school marketing competition, ranked from lowest to highest.

| 5 | 8 | 9 | 11 | 11 | 11 | 13 |
|---|---|---|---|---|---|---|
| | 14 | 16 | 17 | 18 | 19 | |

(a) Determine the **percentile rank** of a score of **14**

$$Percentile(p) = \left( \frac{L + 0.5E}{n} \right) \times 100$$

# of scores less than 14 = 7
# of scores exactly 14 = 1
# of data (scores) = 12



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# CHAPTER 4.1 STATISTICAL MEASURES

***EXAMPLE 3***

*Percentile and Percentile Rank*

Below are the scores on a high school marketing competition, ranked from lowest to highest.

| 5 | 8 | 9 | 11 | 11 | 11 | 13 |
|---|---|---|---|---|---|---|
| | 14 | 16 | 17 | 18 | 19 | |

(a) Determine the **percentile rank** of a score of **14**

$$Percentile(p) = \left(\frac{L + 0.5E}{n}\right) \times 100$$

# of scores less than 14 = 7
# of scores exactly 14 = 1
# of data (scores) = 12

$$Percentile(p) = \left(\frac{7 + 0.5(1)}{12}\right) \times 100$$

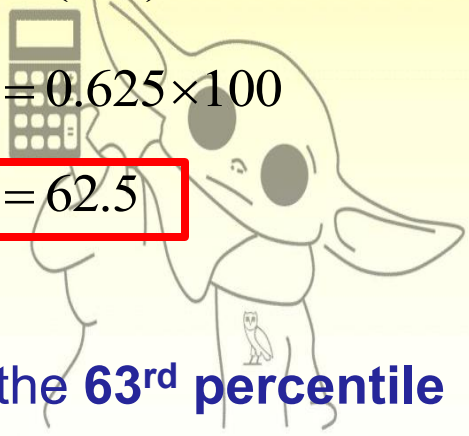
$$Percentile(p) = \left(\frac{7 + 0.5}{12}\right) \times 100$$

$$Percentile(p) = \left(\frac{7.5}{12}\right) \times 100$$

$$Percentile(p) = 0.625 \times 100$$

$$Percentile(p) = 62.5$$

A score of 14 is in the **63rd percentile**



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# CHAPTER 4.1 STATISTICAL MEASURES

***EXAMPLE 3***

*Percentile and Percentile Rank*

Below are the scores on a high school marketing competition, ranked from lowest to highest.

| 5 | 8 | 9 | 11 | 11 | 11 | 13 |
|---|---|---|---|---|---|---|
| | 14 | 16 | 17 | 18 | 19 | |

(b) Determine the **percentile rank** of a score of **11**

$$Percentile(p) = \left(\frac{L + 0.5E}{n}\right) \times 100$$

# of scores less than 11 = 3
# of scores exactly 11 = 3
# of data (scores) = 12

$$Percentile(p) = \left(\frac{3 + 0.5(3)}{12}\right) \times 100$$

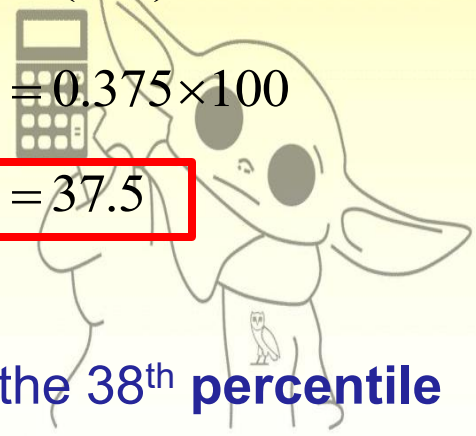
$$Percentile(p) = \left(\frac{3 + 1.5}{12}\right) \times 100$$

$$Percentile(p) = \left(\frac{4.5}{12}\right) \times 100$$

$$Percentile(p) = 0.375 \times 100$$

$$Percentile(p) = 37.5$$

A score of 11 is in the 38th **percentile**



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# CHAPTER 4.1 STATISTICAL MEASURES

***EXAMPLE 3***

*Percentile and Percentile Rank*

Below are the scores on a high school marketing competition, ranked from lowest to highest.

5 8 9 11 11 11 13 14 16 17 18 19

0.75 0.95

(c) Which score is in the **75th percentile**?

*Step 1: Find the score position*

*Score position* = $p \times n$

$= 0.75 \times 12$

$= 9$

*Step 2: Determine the score in the position*

*A score of **16** is in the 75th percentile*

(d) Which score is in the **95th** percentile?

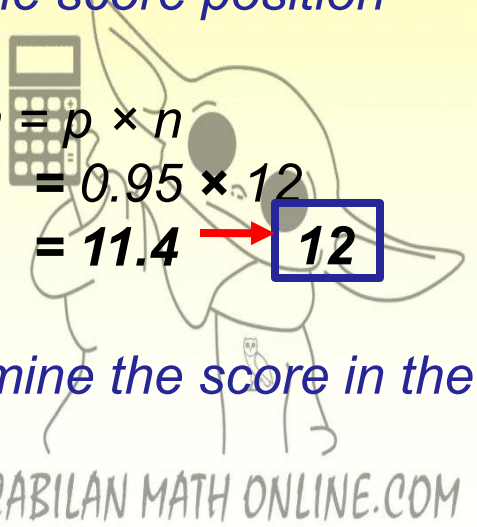
*Step 1: Find the score position*

*Score position* = $p \times n$

$= 0.95 \times 12$

$= 11.4 \rightarrow 12$

*Step 2: Determine the score in the position*




*A score of **19** is in the 95th percentile*

# CHAPTER 4.1 STATISTICAL MEASURES

A **weighted mean** is a mean in which each component has a different weighting factor. For example, a teacher's mark weightings may be different for each type of evaluation

***EXAMPLE 4*** *Weighted Mean*

A high school teacher uses a weighted mean to calculate his students' marks. Below are Armando's marks along with the weighting. Complete the table below to determine Armando's overall mark.

ARMANDO'S MARKS

| ASSESSMENT | MARK | PERCENTAGE | WEIGHT | VALUE |
|---|---|---|---|---|
| Quiz | 24 / 30 | $\left(\frac{24}{30}\right)\times 100 = 80$ | 15% | $80\times 0.15$ $=12\%$ |
| Assignment | 40 / 60 | | 15% | |
| Test | 89 / 120 | | 25% | |
| Independent study | 43 / 60 | | 10% | |
| Performance Task | 85 /100 | | 10% | |
| Final Exam | 72 / 90 | | 25% | |
| OVERALL MARK (add up the last column) | | | | |

# CHAPTER 4.1 STATISTICAL MEASURES

***EXAMPLE 4*** *Weighted Mean*

ARMANDO'S MARKS

| ASSESSMENT | MARK | PERCENTAGE | WEIGHT | VALUE |
|---|---|---|---|---|
| Quiz | 24 / 30 | $\left(\frac{24}{30}\right)\times 100 = 80$ | 15% | $80 \times 0.15 = 12\%$ |
| Assignment | 40 / 60 | $\left(\frac{40}{60}\right)\times 100 = 66.7$ | 15% | 66.7 x 0.15 = **10%** |
| Test | 89 / 120 | $\left(\frac{89}{120}\right)\times 100 = 74.2$ | 25% | 74.2 x 0.25 = **18.55%** |
| Independent study | 43 / 60 | $\left(\frac{43}{60}\right)\times 100 = 71.7$ | 10% | 71.7 x 0.10 = **7.17%** |
| Performance Task | 85 /100 | $\left(\frac{85}{100}\right)\times 100 = 85$ | 10% | 85 x 0.10 = **8.5%** |
| Final Exam | 72 / 90 | $\left(\frac{72}{90}\right)\times 100 = 80$ | 25% | 80 x 0.25 = **20%** |
| OVERALL MARK (add up the last column) | | | | **76.22%** |

# CHAPTER 4.1 STATISTICAL MEASURES

## *HOMEWORK / SEATWORK*

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