**Ratio** – a comparison of two numbers or quantities **with the same units.**

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Figure : There are 3 black squares to 1 grey square

Ratios can be show in different ways:

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| --- | --- |
| **a**. 2 cups of milk to 7 cups of water | **b**. $5 to $9 |

Example 2: Write each ratio in simplest form.

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| --- | --- | --- |
| **a**.   | **b**. 4:12 | **c**. 6 to 10 |

**Example 3:** Write the following ratios in simplest form:

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| --- | --- | --- |
| **a.** 45 minutes to 1 hour | **b**. 250 g to 1kg | **c.** 1m to 175cm |

**Rate** – a comparison of two numbers having **different units**.

A rate is usually written as a ‘unit rate’, in which the second term is always 1.

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| --- | --- |
| **Example 4:**John earns $60 for working 4 hours. What is his rate of pay? | **Example 5:**A car runs at a speed of 30m/s. How far can it run in 1 minute? |
| **Example 6:**A 200g bag of mixed nuts costs $3.40. Calculate the unit rate. | **Example 7: A Comparison**A 200g bag of popcorn costs $6.00. A 500g bag costs $10.00. Find the unit rate of each bag to compare which size is the better value. |

**Proportion** – is an equation which states that two ratios are equal. 



Some proportions can be solved with simple multiplication or division between equivalent ratios, others are more complicated and can be solved using ‘cross multiplication’.

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| **Example 8**:  | **Example 9**:  | **Example 10**:  *\*see below* |

**Cross multiplication**

Example 1: Find the missing value ‘m’

\*You should be able to answer this by solving the ‘simple’ equivalent fraction but I will use this simple example to show you how cross multiplication works.

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| --- | --- | --- | --- | --- |
| Question | Draw the cross | STEP 1: Set up the equation | STEP 2: Simplify | STEP 3: Get the unknown value alone by dividing both sides by the number on the same side as the unknown value. |
|  |  |  |  |  |

Example 2:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Question | Draw the cross | STEP 1: Set up the equation | STEP 2: Simplify | STEP 3: Get the unknown value alone by dividing both sides by the number on the same side as the unknown value. |
|  |  |  |  |  |

**Proportion Problems:**

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| **Example 11:**A pendulum completes 7 swings every three seconds. How many swings does it complete in a minute? | **Example 12:** Apples are $2.00 per dozen (12), how many apples can you get for $5.50? | **Example 13:** A 17” computer monitor has a width of 15”. Since monitors are proportionate, what is the width of 48” computer monitor? |

**Practice: Ratios, Rates, and Proportions**

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| --- |
| Write the following as ratios in lowest terms |
| a. 73 days to 1 year | b. 35cents to $1.05 | c. 750 mL to 1.5 L | d. 3 min to 45 sec |
| Find the unit rate of the following: |
| e. Mike earns $42 in 6 hours. | f. $350 for 8 people to attend a party | g. 24 pop for $6.96 |
| **Answer** the following rate problems: |
| h. Jack earned $50 in 10 hours, while John earned $105 in 20 hours. Which person had the better rate of pay? | i. A bus travels 10 km in 25 minutes. At this rate, how far will the bus travel in one hour? |
| j. Oranges are $2.00 per dozen. At this rate, how many oranges could you get for $3.50 | k. Katherine cycled 30 km in 2 hours. If she continues at the same rate, what distance will she travel in 7 hours? |
| l. Which is the better value? $350 for a bus of 35 people, or $440 for a bus of 40 people? | m. Which is the better value? 28 g of mixed nuts for $0.84, or 35g of mixed nuts for $1.40? |
| Find the missing value in the following proportions \*round to 2d.p. where necessary |
| n.  | o.  | p.  | q.  |
| ANSWERS: a. 1:5, b. 1:3, c. 5:6, d. 4:1, e. $7/h, f. $43.75/p, g. $0.29/pop, h. John, i. 24km/h, j. 21oran., k. 105 km, l. $350/35, m. 28g/$0.84, n. m=1.88, o. k=0.82, p. p=7, q. y=1.6 |