BASIC 8

WEEKLY LESSON PLAN – WEEK 7

Strand:	Number	**Sub-Strand:**	Ratio and Proportion

Content Standard:	B8.1.4.1 Demonstrate an understanding of ratio, rate and proportions and use it these to solve real-world mathematical problems	
Indicator (s)	B8.1.4.1.3 Apply the knowledge of speed to draw and interpret travel graphs or distance-time graphs. B8.1.4.1.4 Recognize and represent proportional relationships between quantities by deciding whether two quantities are in a proportional relationship. (e.g. by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin). B8.1.4.1.5 Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.	**Performance Indicator:** Learners can identify constant proportionality from a graph.
Week Ending	11-08-2023	

Class	B.S.8	**Class Size:**		**Duration:**	

Subject	Mathematics
Reference	Mathematics Curriculum, Teachers Resource Pack, Learners Resource Pack, Textbook.

Teaching / Learning Resources	Chart, Poster, picture, Video.	**Core Competencies:**	• Implement strategies with accuracy • Ability to combine Information and ideas from several sources to reach a conclusion • Implement strategies with accuracy

DAY/DATE	**PHASE 1 : STARTER**	**PHASE 2: MAIN**	**PHASE 3: REFLECTION**
MONDAY	Demonstrate on drawing a graph for a passage on a distance time graph for the Learners to observe.	1. Assist learners to practice solving examples of drawing a graph for a passage on a distance time graph. 2. Show learners a video on how to interpret and work with distance-time and speed-time graphs. 3. Learners brainstorm to interpret travel graphs. **Travel Graphs**	Reflect on how t interpret distance-time and speed-time graphs. **Exercise;**

Speed, Distance and Time

The following is a basic but important formula which applies when speed is constant (in other words the speed doesn't change):

$$\text{Speed} = \frac{\text{distance}}{\text{time}}$$

Remember, when using any formula, the units must all be consistent. For example speed could be measured in m/s, distance in metres and time in seconds.

If speed does change, the average (mean) speed can be calculated:

$$\text{Average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

Units

In calculations, units must be consistent, so if the units in the question are not all the same (e.g. m/s, m and s or km/h, km and h), change the units before starting, as above.

The following is an example of how to change the units:

Example

Change 15km/h into m/s.
15km/h = 15/60 km/min (1)
= 15/3600 km/s = 1/240 km/s (2)
= 1000/240 m/s = 4.167 m/s (3)

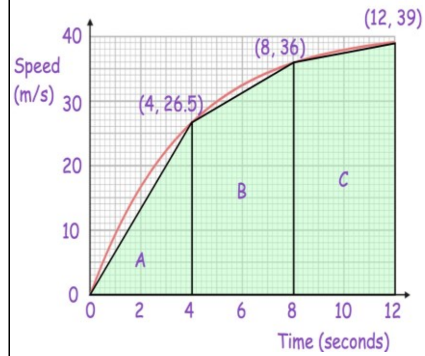
In line (1), we divide by 60 because there are 60 minutes in an hour. Often people have problems working out whether they need to divide or multiply by a certain number to change the units. If you think about it, in 1 minute, the object is going to travel less distance than in an hour. So we divide by 60, not multiply to get a smaller number.

Example

If a car travels at a speed of 10m/s for 3 minutes, how far will it travel?
Firstly, change the 3 minutes into 180 seconds, so that the units are consistent. Now rearrange the first equation to get distance = speed × time.
Therefore distance travelled = 10 × 180 = 1800m
= 1.8km

Velocity and Acceleration

1. Here is the speed-time graph for a car's journey.



(a) Work out the area of triangle A

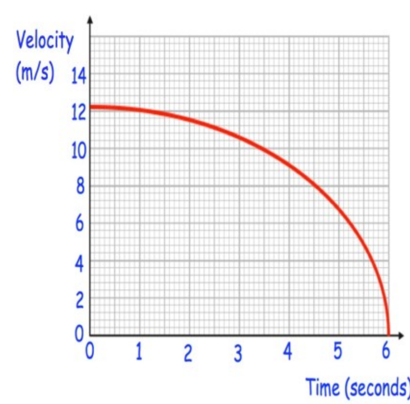
(b) Work out the area of trapezium B

(c) Work out the area of trapezium C

(d) Using your answers to (a), (b) and (c) to Qind an estimate for the total distance travelled by the car.

(e) Is your answer to (d) an overestimate or an underestimate for the distance that the car travelled?

2. Here is a velocity-time graph for 6 seconds of a journey.



(a) Work out an estimate for the distance travelled over 6 seconds. Use 3 strips of equal width.

Velocity is the speed of a particle <u>and</u> its direction of motion (therefore velocity is a vector quantity, whereas speed is a scalar quantity).

When the velocity (speed) of a moving object is increasing we say that the object is *accelerating*. If the velocity decreases it is said to be decelerating. Acceleration is therefore the rate of change of velocity (change in velocity / time) and is measured in m/s^2.

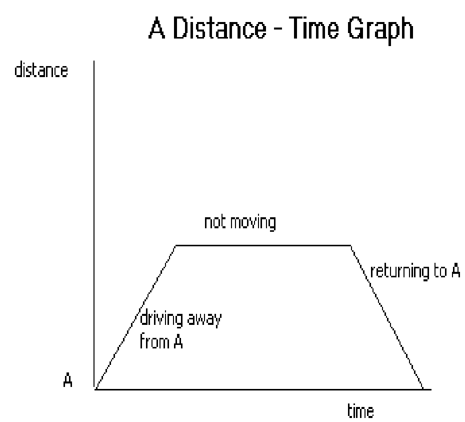
Example

A car starts from rest and within 10 seconds is travelling at 10m/s. What is its acceleration?

$$\text{Acceleration}=\frac{\text{change in velocity}}{\text{time}}=\frac{10}{10}=1\,m/s^2$$

<u>Distance-Time Graphs</u>

These have the distance from a certain point on the vertical axis and the time on the horizontal axis. The velocity can be calculated by finding the gradient of the graph. If the graph is curved, this can be done by drawing a chord and finding its gradient (this will give average velocity) or by finding the gradient of a tangent to the graph (this will give the velocity at the instant where the tangent is drawn).



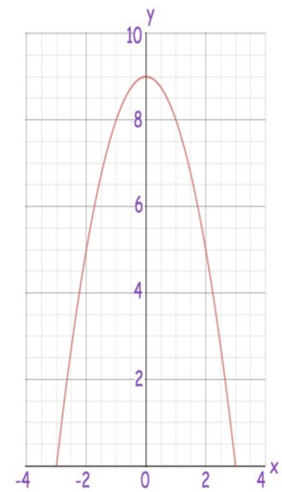
<u>Velocity-Time Graphs/ Speed-Time Graphs</u>

A velocity-time graph has the velocity or speed of an object on the vertical axis and time on the horizontal axis. The distance travelled can be calculated by finding the *area* under a velocity-time graph. If the graph is curved, there are a number of ways of estimating the area (see trapezium rule below). Acceleration is the gradient of a velocity-time graph and on curves can be calculated using chords or tangents, as above.

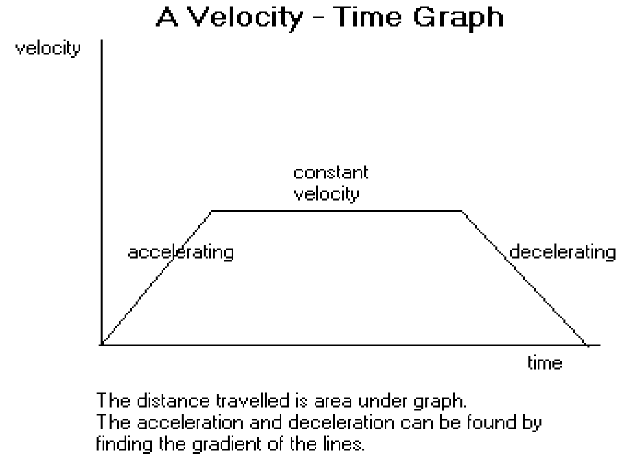
(b) Is your answer to (a) an overestimate or an underestimate of the actual distance travelled?

3. Here is a sketch of y = 9 − x2. The graph is used to model the cross section of a tunnel.

2



Calculate an estimate of the area under the graph.

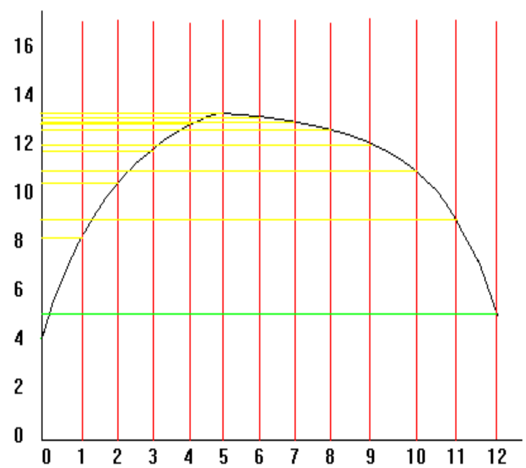


The distance travelled is the area under the graph. The acceleration and deceleration can be found by finding the gradient of the lines.

On travel graphs, time always goes on the horizontal axis (because it is the independent variable).

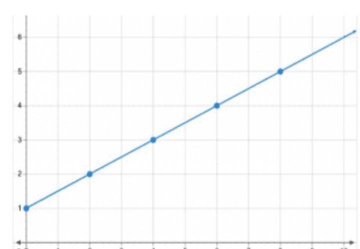
<u>Trapezium Rule</u>

This is a useful method of estimating the area under a graph. You often need to find the area under a velocity-time graph since this is the distance travelled.

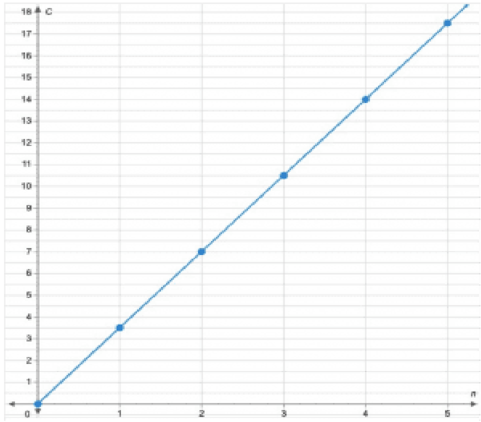


Area under a curved graph = ½ × d × (first + last + 2(sum of rest))

d is the distance between the values from where you will take your readings. In the above example, d = 1. Every 1 unit on the horizontal axis, we draw a line to the graph and across to the y axis.
'first' refers to the first value on the vertical axis, which is about 4 here.

		'last' refers to the last value, which is about 5 (green line).] 'sum of rest' refers to the sum of the values on the vertical axis where the yellow lines meet it. Therefore area is roughly: ½ × 1 × (4 + 5 + 2(8 + 8.8 + 10.1 + 10.8 + 11.9 + 12 + 12.7 + 12.9 + 13 + 13.2 + 13.4)) = ½ × (9 + 2(126.8)) = ½ × 262.6 = <u>131.3 units²</u>	
TUESDAY	Discuss with Learners on how to recognize and represent proportional relationships between quantities	1. Learners brainstorm to identify examples of proportional relationship. 2. Assist Learners to identify and represent proportional relationships between quantities. 3. Discuss with Learners on how to recognize and represent proportional relationships and use them to solve problems 4. Assist Learners to use given tables to check proportional relationship. **Proportional Relationships in Equations** Lines that pass through the origin have a constant of proportionality, k. For any proportional relationship, k= y/x (such as a line that passes through the origin). Find the equation of the line by solving for y in the constant of proportionality equation. K=y/x x.k=y/x .x kx=y	Learners in small groups to discuss and use graphs to check proportional and non-proportional relationship.
THURSDAY	Demonstrate on how to find the constant of proportionality unit rate from a graph.	1. Discuss the unit rate of a proportional graph with the Learners. 2. Learners in small groups to discuss and calculate unit rates and write proportional equations 3. Assist Learners to find the constant proportionality from a table of values, equations and a graph. Example 1 Represent the cupcake equation, C = 3.5n, from the previous lesson by a graph. **Solution:** Make a table of values that satisfy the	Through questions and answers, conclude the lesson. **Exercise;** 1.  Does the table represent a proportional relationship? 2. A plumber charges $60 for the first hour of work, and $40 for every addition hour

equation.



Cupcakes	
Number	Cost
0	$0
1	$3.50
2	$7.00
3	$10.50
4	$
5	$

These are points on the graph. Draw a ray through the points. Note that only the bulleted points on this graph correspond to actual cupcakes, because they do not sell fractions of cupcakes. In the graph for quarts and pints, all points on the ray would represent real values.

Equations from graphs

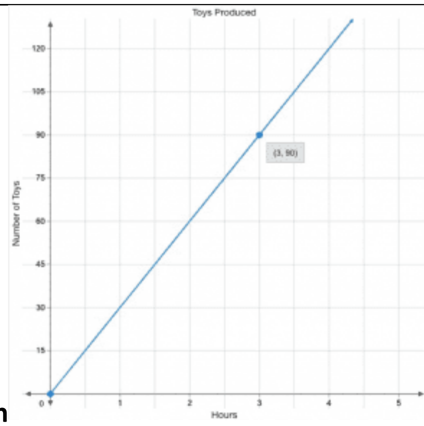
If you are given the graph of a proportional relationship, you can determine its equation.

Example 2

The graph for the number of toys produced in a factory over the course of several hours is shown. What do the points (0, 0) and (3, 90) represent? What is the constant of proportionality and the equation representing the graph?

of work. Is the relationship between total cost and number of hours proportional?

3. Draw the graphs of the given equations;
   - i. y = 3x, where x = the number of lbs. of ground beef, and y = the price in $
   - ii. y = 0.5x, with no restrictions on the variables

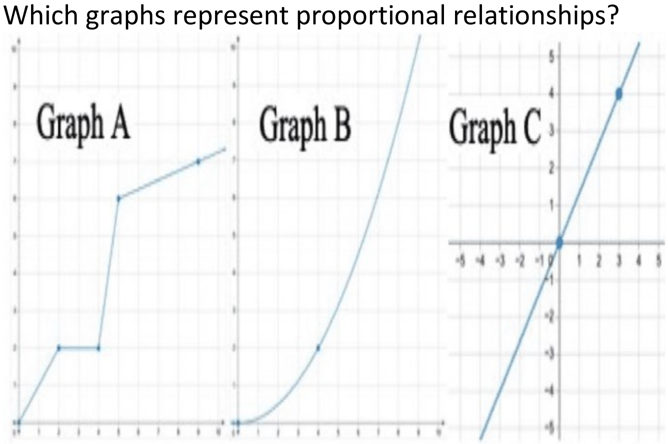


Solution:
The graph is a ray starting at the origin, so it represents a proportional relationship.
The point represents the fact that when no time has passed (0 hours), no toys have been produced (0 toys).
The point represents the fact that when __ hours have passed, ____ toys have been produced. The unit rate, or constant of proportionality, is $^{90}/_{3}$ ________toys per hour. This could be computed using the coordinates of any point on the graph (other than (0, 0)), because the ratio $^{y}/_{x}$ is constant (definition of proportional relationship). The equation for this graph is y = 30x.

This graph contains the point (1, 30). This represents the fact that after 1 hour, 30 toys have been produced. These coordinates directly show the unit rate. In general, the point (1, r) on the graph of a proportional relationship shows that the unit rate is r.

Determining if a relationship is proportional
If the graph of a relationship is a line or a ray through the origin, then it is proportional. If it is a line or ray that does not pass through the origin, then it is not proportional. Also, if it is not linear, then it is not proportional.

Example 3
Which graphs represent proportional relationships?



		Solution: All three graphs pass through the origin (that is, the point (__,__)). Graph C is also a line. So it represents a proportional relationship. Graph A is composed of line segments, but it is not a ray or a line. Graph B is a curve. So neither of these is a proportional relationship. You can start with a table or a verbal description and produce a graph. Then you can determine if it is proportional from the graph.	

Name of Teacher: ***School:*** ***District:***