

Solutions

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1. A tanker truck carrying fuel initially contains 10 000 L. Fuel is added to the tank at a rate of 2000 litres per minute.

- Determine an equation to model the volume of fuel in the truck t minutes after filling begins.
- Use your equation to determine the volume of fuel in the truck after it has been filling for 5 minutes.
- Use your equation to determine how long it takes to fill the truck, which has a capacity of 36 000 litres.

$$a) \quad V = 10,000 + 2000t$$

initial value
rate of change

$$b) \quad \text{Sub in } t = 5$$

$$\Rightarrow V = 10,000 + 2000(5)$$

$$V = 10,000 + 10,000$$

$$V = 20,000 \text{ L}$$

$$c) \quad \text{Sub in } V = 36,000$$

$$\Rightarrow 36,000 = 10,000 + 2000t$$

$$\begin{array}{r} 26,000 = 2000t \\ \underline{2,000} \quad \underline{2000} \\ t = 13 \text{ minutes} \end{array}$$

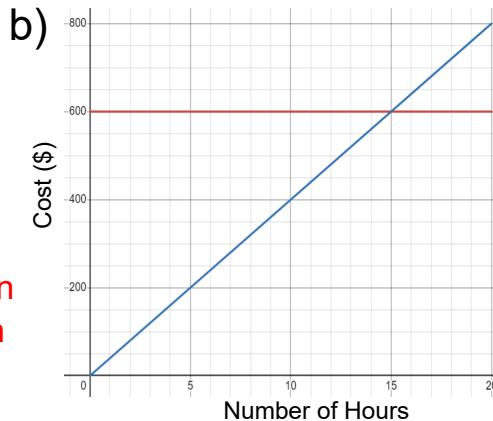
2. An event planner offers the following two pricing options:

Option A: A one-time up-front payment of \$600.

Option B: A rate of \$40/h, paid after the event.

- If an event is expected to require 10 hours of planning, which option will result in a lower cost to the customer, and by how much?
- Create a graph to compare the total cost of hiring the event planner using each of the two pricing options from 0 hours to 20 hours.
- Explain the meaning of the point where the two lines intersect.
- Explain why a customer might choose Option A.

a) Option A = \$600,
 Option B = $40(10)$
 = \$400
 Option B is cheaper by \$200

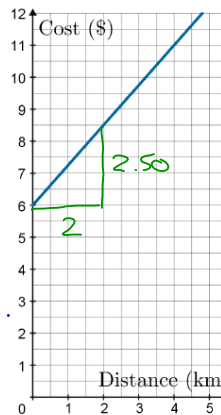


c) Point of intersection is when both options cost the same, in this case, \$600.

d) You might choose Option A if you are unsure of how many hours you need or if you are definitely going to need more than 15 hours.

3. The graph below describes the taxi fare in Fredericton, New Brunswick. In Ottawa, Ontario, the initial cost is \$2.25 less, but the rate is greater by \$0.75/km.

- How would the graph for the Ottawa taxi compare to the graph for the Fredericton taxi?
- Determine an equation for the total cost of a taxi ride for d kilometres in Ottawa.
- For what distance would the Fredericton and Ottawa taxis charge the same amount?



a) It would start at \$3.75 (lower y-intercept) but would have a steeper line.

b) Rate of change in Fredericton = $\frac{2.50}{2} = \$1.25/\text{km}$

\Rightarrow R of C in Ottawa = $1.25 + 0.75 = \$2/\text{km}$

\Rightarrow Cost in Ottawa $C = 3.75 + 2d$
 initial cost cost/km

c) Fredericton $C = 6 + 1.25d$

Cost the same when $6 + 1.25d = 3.75 + 2d$

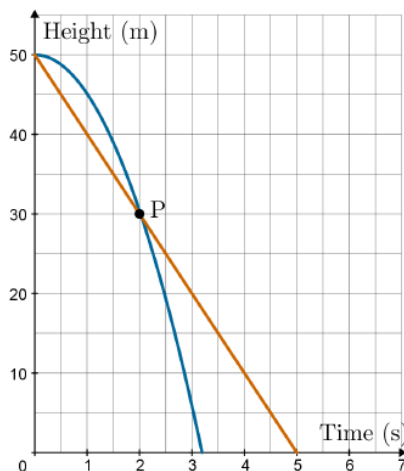
$$6 - 3.75 = 2d - 1.25d$$

$$\frac{2.25}{0.75} = \frac{0.75d}{0.75d}$$

$\Rightarrow d = 3 \text{ km}$ will cost the same

4. The graphs below show the heights of two objects above the ground over time. One graph corresponds to a freefalling ball and the other describes a descending drone.

- Which graph represents the ball and which graph represents the drone? Explain.
- What happens at point P? Explain.
- Which object contacts the ground first?
- Which object is travelling faster when it reaches the ground? Explain.



a) Straight line \rightarrow drone
(controlled descent)
Curved line \rightarrow ball
(gravity causing descent to accelerate)

b) Both have a height of 30m above the ground after 2 seconds. The lines are intersecting.

c) Ball hits the ground first.

d) Ball is travelling faster when it hits the ground (line is steeper).

5. To convert a temperature measured in degrees Celsius to degrees Fahrenheit, we multiply the degrees Celsius temperature by 1.8 and add 32 to the result.

- Create an equation that relates temperature in degrees Fahrenheit (F) to temperature in degrees Celsius (C).
- The average normal body temperature is 37°C . Use your equation to convert this temperature to degrees Fahrenheit.

$$a) F = 1.8C + 32$$

$$b) F = 1.8(37) + 32$$

$$F = 66.6 + 32$$

$$F = 98.6^{\circ}$$

5. To convert a temperature measured in degrees Celsius to degrees Fahrenheit, we multiply the degrees Celsius temperature by 1.8 and add 32 to the result.
- c) The Centers for Disease Control and Prevention (CDC) defines a fever as a body temperature of 100.4°F or higher. Determine this temperature range in degrees Celsius.
- d) Determine the freezing temperature in degrees Fahrenheit.

$$c) \quad 100.4 = 1.8C + 32$$

$$100.4 - 32 = 1.8C + 32 - 32$$

$$\frac{68.4}{1.8} = \frac{1.8C}{1.8}$$

$$38 = C$$

$\Rightarrow 38^{\circ}\text{C}$ or higher.

$$d) \quad F = 1.8C + 32$$

$$F = 1.8(0) + 32$$

$$F = 0 + 32$$

$$F = 32^{\circ}$$

6. The volume of liquid, in litres, in two containers after t minutes is given by the following equations.

Container A: $V = 10t + 50$

Container B: $V = 120 - 8t$

- a) State the initial volume of liquid in each container.
 b) State whether each container is filling or draining.
 c) After approximately how many minutes do the containers contain the same volume of liquid?

a) A starts with 50 litres
 B starts with 120 litres

b) A is filling (positive rate of change (10))
 B is draining (negative rate of change (-8))

c) Find when "V's are equal"

$$\Rightarrow 10t + 50 = 120 - 8t$$

$$10t + 8t = 120 - 50$$

$$\frac{18t}{18} = \frac{70}{18}$$

$$t = 3.8$$

Volumes are equal
 after about
 3.9 minutes.