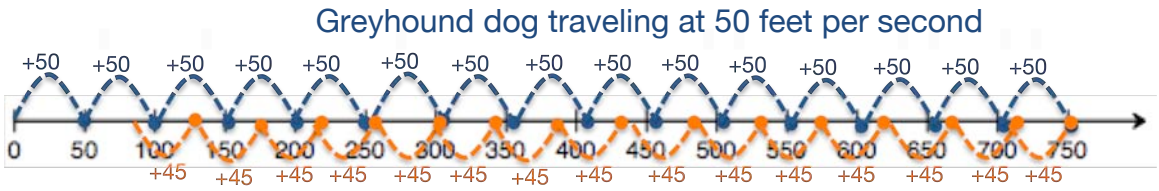
# Linear Equations: Expressions and Diagrams

## Extend Your Learning
## Answers and Explanations

1. Greyhounds are very fast dogs that run at an average rate of 50 feet per second. Some greyhounds are involved in racing where they chase an artificial lure around a track. How long would it take a greyhound to overtake the lure if the lure had a 75 foot lead and moves at a rate of 45 feet per second? What distance must the greyhound travel to overtake the lure?

**Diagram**




The dog would catch the lure after 15 seconds at 750 feet.

**Expressions**

n: number of seconds

**Greyhound dog**

| rate (ft per second) | seconds | distance |
|---|---|---|
| 50 | 1 | 50·1 |
| 50 | 2 | 50·2 |
| 50 | n | 50·n |

The distance the greyhound travels can be represented by 50n since the dog travels at 50 feet per second.

**Lure**

| rate (ft per second) | seconds | distance |
|---|---|---|
| 45 | 1 | 45·1 |
| 45 | 2 | 45·2 |
| 45 | n | 45·n |

The distance the lure travels can be represented by 75 + 45n since the lure is 75 feet ahead of the dog at the start and moves at a rate of 45 feet per second.

**Using Expressions**

To check the solution from the diagram above, substitute the value of n = 15 into both expressions and check to see if the distance is the same.

| Greyhound's distance | Lure's distance |
|---|---|
| 50n | 75 + 45n |
| 50(15) | 75 + 45(15) |
| 750 | 750 |

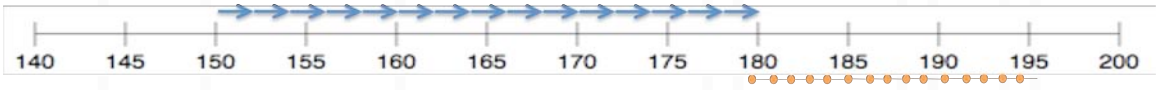
The greyhound overtakes the lure after 15 seconds at 750 feet into the race.

2. Tom and Juan are beginning a training program for the upcoming football season. Tom weighs 150 pounds and plans to gain 2 pounds per week through this training program. Scott weighs 195 pounds and plans to lose 1 pound per week. If their plans work, in how many weeks will they weigh the same amount? What will their weight be at that time?

**Diagram**

**Tom's weight gain**

Each arrow represents gaining 2 pounds per week




**Juan's weight loss**

Each dot represents losing 1 pound per week

**Expressions**

n: number of weeks

**Tom's Weight**

| rate of weight gain (pounds per week) | # of weeks | weight gain |
|---|---|---|
| 2 | 1 | 2·1 |
| 2 | 2 | 2·2 |
| 2 | n | 2·n |

Tom's weight can be represented by 150 + 2n since he weighs 150 pounds at the beginning of his training program, and he gains 2 pounds per week.

**Juan's Weight**

| rate of weight loss (pounds per week) | # of weeks | Weight loss |
|---|---|---|
| 1 | 1 | 1·1 |
| 1 | 2 | 1·2 |
| 1 | n | 1·n |

The total weight for Juan can be represented by 195 - 1n since he weighs 195 pounds at the beginning of his training program and loses 1 pound per week.

**Using Expressions**

To check the solution from the diagram above, substitute the value of n = 15 into both expressions and check if the weight is the same.

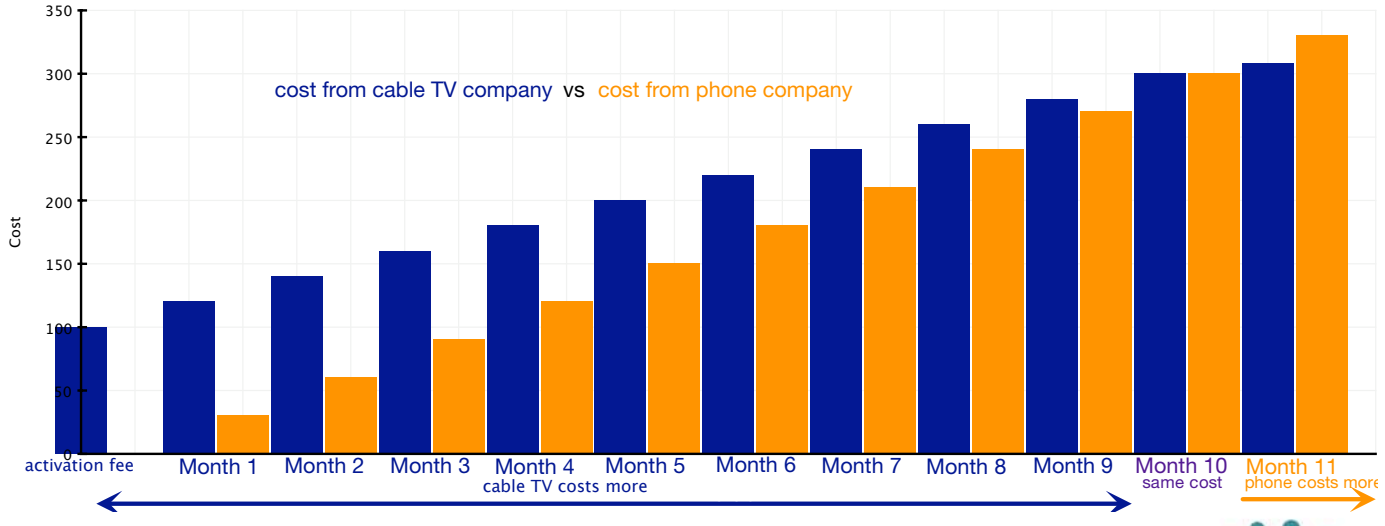
Tom's Weight
150 + 2n
150 + 2(15)
180

Juan's weight
195 - 1n
195 - 1(15)
180

Tom and Juan would both weigh 180 pounds after 15 weeks.

3. Jennifer would like to get broadband Internet service for her house. She is considering either the local phone company or the cable TV provider. Jennifer finds that the phone company would have no activation fee but their charge for service is $30 per month. The cable TV company has a $100 activation fee with a $20 per month charge for service. Which is the better value?

**Diagram**



**Expressions**

m: number of months

**Cost at phone company**

| rate (dollars per month) | # of months | monthly cost |
|---|---|---|
| 30 | 1 | 30·1 |
| 30 | 2 | 30·2 |
| 30 | n | 30·n |

The total cost for the phone company can be represented by 30m since there is no activation fee and the monthly cost is $30.

**Cost at cable TV company**

| rate dollars per month | # of months | monthly cost |
|---|---|---|
| 20 | 1 | 20·1 |
| 20 | 2 | 20·2 |
| 20 | n | 20·n |

**Using Expressions**

To check the solution from the diagram above, substitute the value of m = 10 into both expressions and check if the cost is the same.

Cost at phone company
30m
30(10)
300

Cost at cable TV company
100 + 20m
100 + 20(10)
300

Between 0 and 10 months the phone company is a better value. After 10 months, the cable TV company is a better value. At 10 months the cost for either company is $300.00. This is shown in the above diagram.