

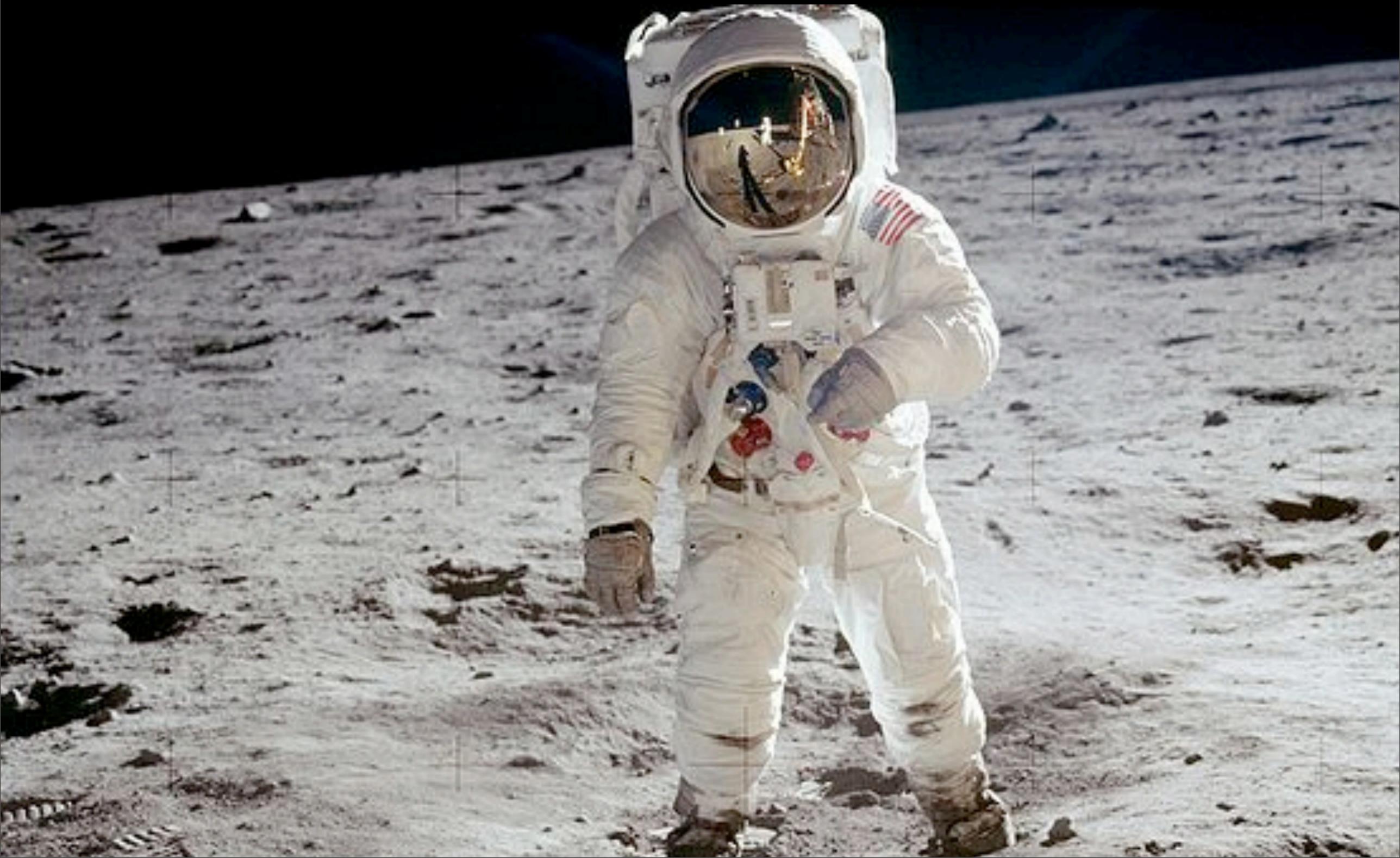
Algebra 1

Predicting Patterns & Examining Experiments

Unit 6: Around the Plane
Section 2: The Change of Sameness

Section 2 examines proportionality and similar shapes.

How much would you weigh on the moon?



(Small group discussion) If weight should be avoided, feel free to ask “how much would Mike Tyson weigh on the moon” or any other public figure that you can find the weight of (boxers are easy in that regard).

A proportion is given on the next slide. This proportionality will be used as a transition into similar figures.

For an extension on this problem, you can find your weight on numerous stars/planets by visiting:

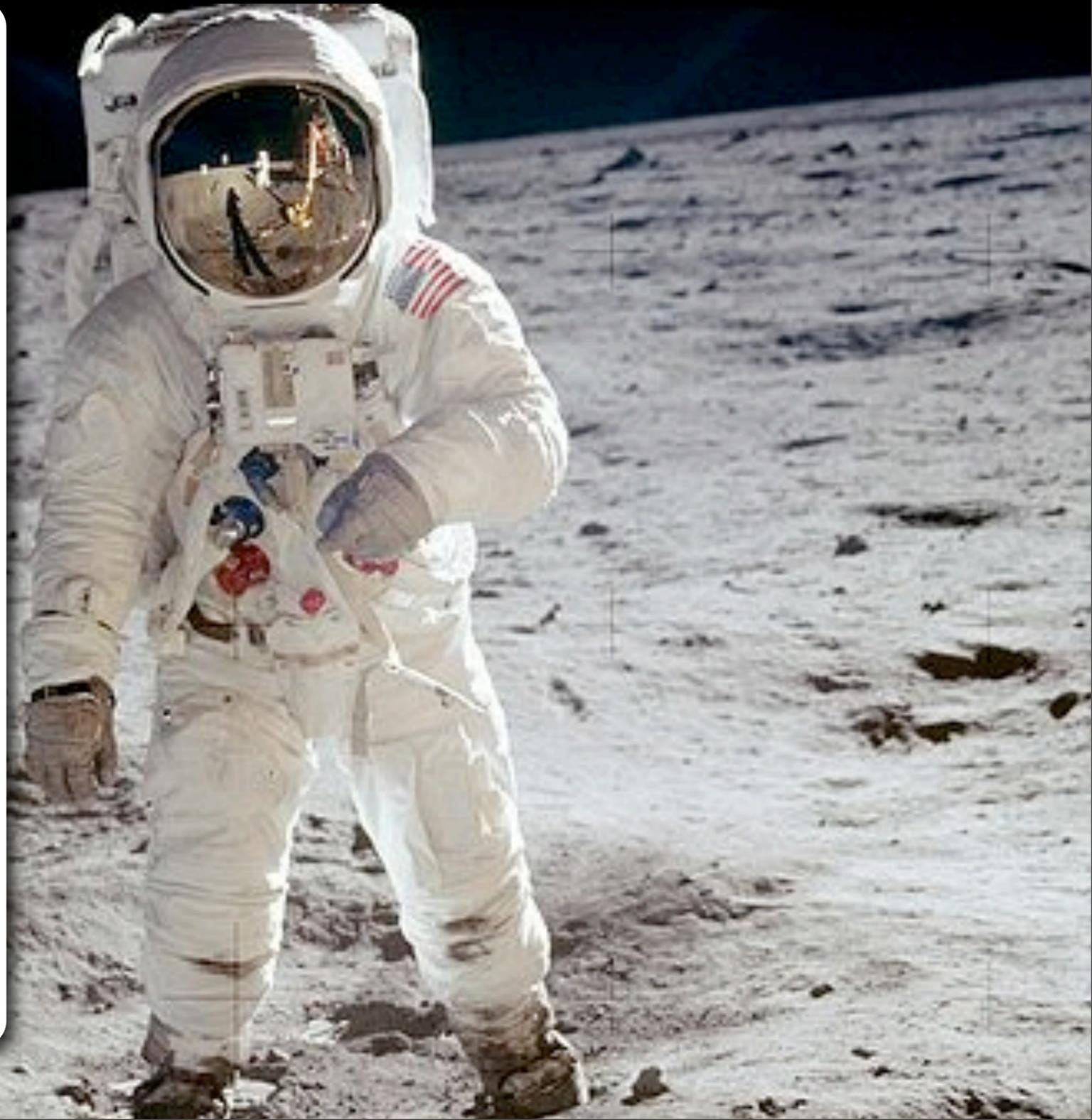
<http://www.exploratorium.edu/ronh/weight/>

How much would you weigh on the moon?

Your weight depends upon not only your mass, but also the mass of the object you're being pulled towards.

Weights on the moon are proportional to weights on earth. For instance, 20 lbs on earth is only 3.32 lbs on the moon.

How much would you weigh on the moon?



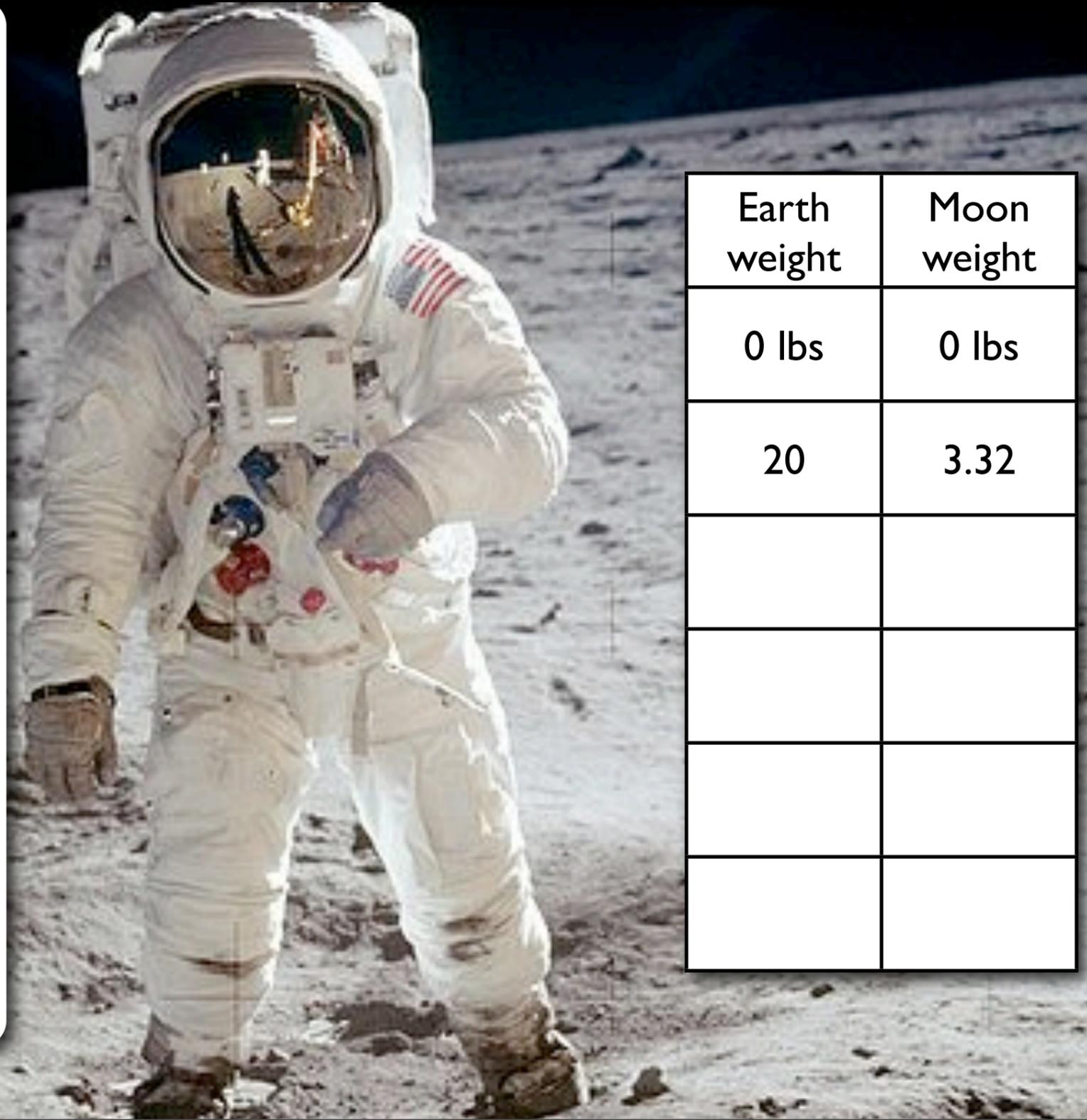
(Small group discussion) necessary info

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How much would you weigh on the moon?



Earth weight	Moon weight
0 lbs	0 lbs
20	3.32

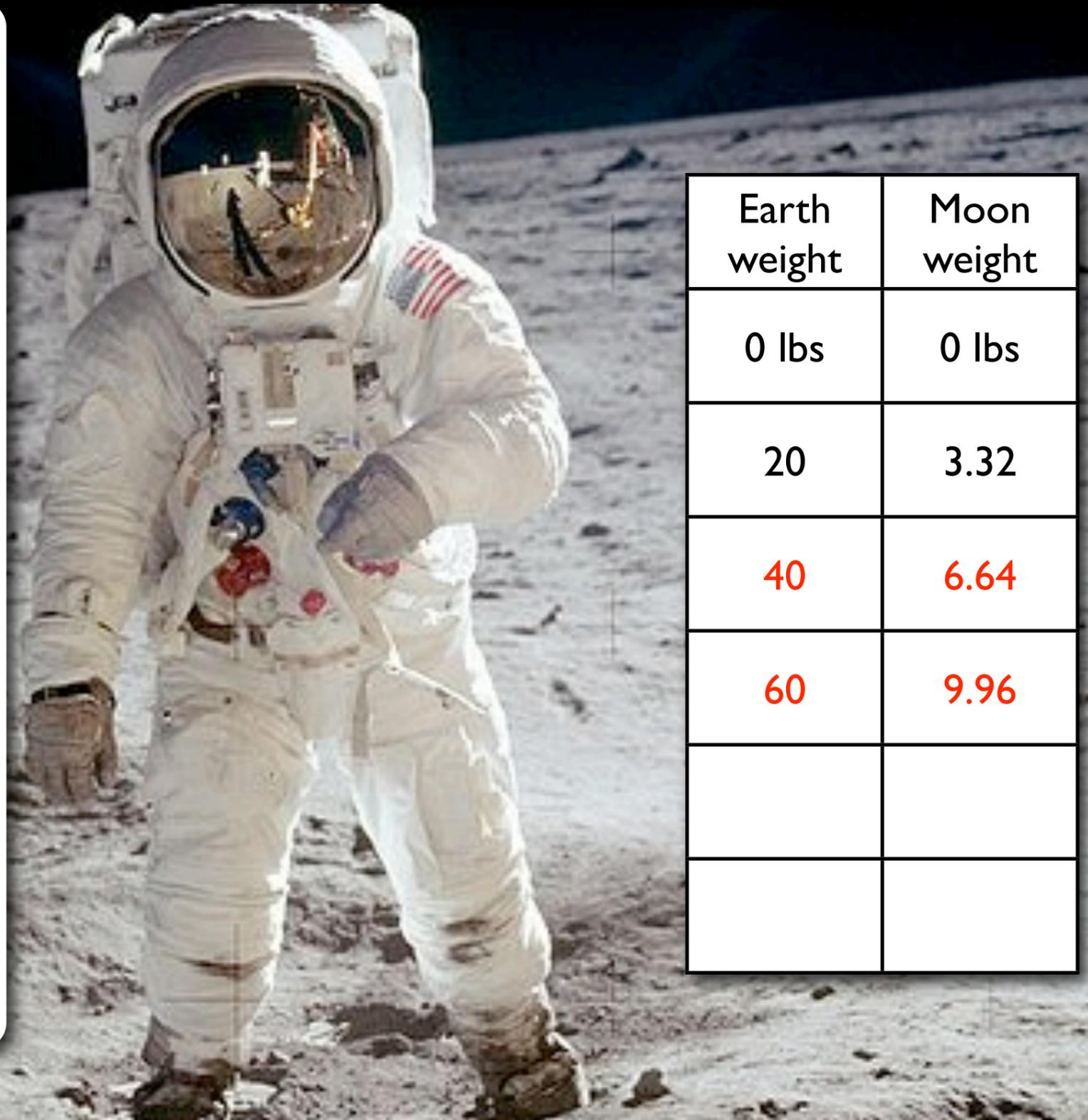
(Small group discussion) Table set-up.

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Weights on the moon are proportional to weights on earth. For instance, 20 lbs on earth is only 3.32 lbs on the moon.

How much would you weigh on the moon?



Earth weight	Moon weight
0 lbs	0 lbs
20	3.32
40	6.64
60	9.96

(Small group discussion) constant slope of proportionality

How much would you weigh on the moon?

Your weight depends upon not only your mass, but also the mass of the object you're being pulled towards.

Weights on the moon are proportional to weights on earth. For instance, 20 lbs on earth is 3.32 lbs on the moon.

How much would you weigh on the moon if you weigh 40 lbs on earth?

$$\text{slope} = \frac{3.32 - 0}{20 - 0} = \frac{3.32}{20} = .166$$

$$y = .166x$$

$$\text{Moonweight} = .166 \cdot \text{Earthweight}$$



Earth weight	Moon weight
0 lbs	0 lbs
20	3.32
40	6.64
60	9.96
x	y

(Small group discussion) constant slope of proportionality – extended to an equation

How much would you weigh on the moon?

Your weight depends upon not only your mass, but also the mass of the object you're being pulled towards.

Weights on the moon are proportional to weights on earth. For instance, 20 lbs on earth is 3.32 lbs on the moon.

How much would you weigh on the moon if you weigh 107 lbs on earth?

$$\text{slope} = \frac{3.32 - 0}{20 - 0} = \frac{3.32}{20} = .166$$

$$y = .166x$$

$$\text{Moonweight} = .166 \cdot \text{Earthweight}$$



Earth weight	Moon weight
0 lbs	0 lbs
20	3.32
40	6.64
60	9.96
107	
x	y

107

x

y

(Small group discussion) Use equation to find any amount

How much would you weigh on the moon?

Your weight depends upon not only your mass, but also the mass of the object you're being pulled towards.

Weights on the moon are proportional to weights on earth. For instance, 20 lbs on earth is 3.32 lbs on the moon.

How much would you weigh on the moon if you weigh 107 lbs on earth?

$$\text{slope} = \frac{3.32 - 0}{20 - 0} = \frac{3.32}{20} = .166$$

$$y = .166x$$

$$\text{Moonweight} = .166 \cdot \text{Earthweight}$$



Earth weight	Moon weight
0 lbs	0 lbs
20	3.32
40	6.64
60	9.96
107	17.762
x	y

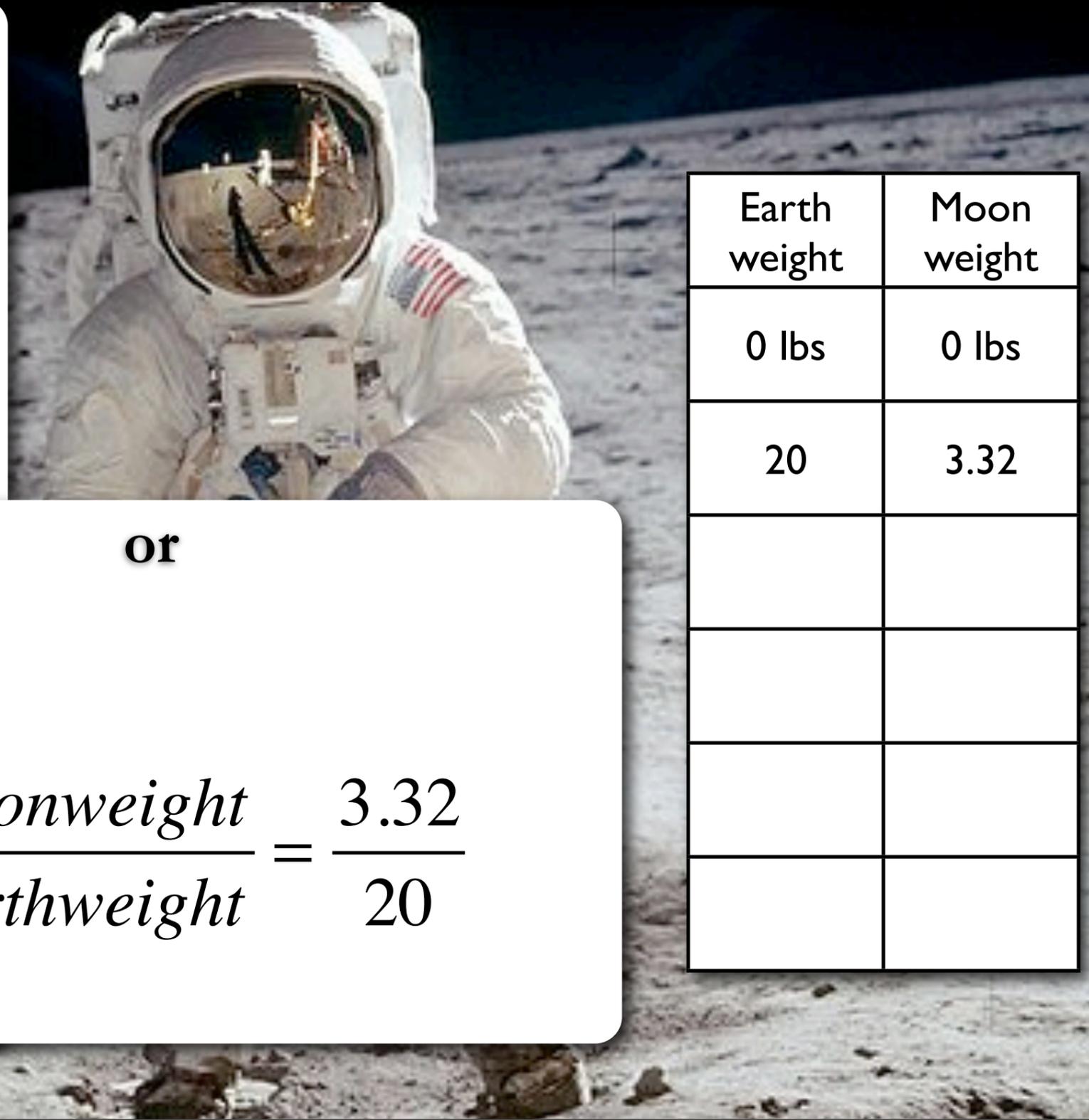
(Small group discussion) Use equation to find any amount

How much would you weigh on the moon?

Your weight depends upon not only your mass, but also the mass of the object you're being pulled towards.

Weights on the moon are proportional to weights on earth. For example, a person who weighs 20 lbs on earth would weigh 3.32 lbs on the moon.

How much would you weigh on the moon?



Earth weight	Moon weight
0 lbs	0 lbs
20	3.32

or

$$\frac{\textit{Moonweight}}{\textit{Earthweight}} = \frac{3.32}{20}$$

(Small group discussion) Since this is a proportional relationship, we don't need to go through all the trouble of deriving an equation. We can just use the proportion to solve for our moonweight.

How much would you weigh on the moon?

Your weight depends upon not only your mass, but also the mass of the object you're being pulled towards.

Weights on the moon are proportional to weights on earth. For example, a person who weighs 20 lbs on earth would weigh 3.32 lbs on the moon.

How much would you weigh on the moon if you weigh 107 lbs on earth?



or

$$\frac{\text{Moonweight}}{\text{Earthweight}} = \frac{3.32}{20}$$

Earth weight	Moon weight
0 lbs	0 lbs
20	3.32
107	

107

(Small group discussion) Since this is a proportional relationship, we don't need to go through all the trouble of deriving an equation. We can just use the proportion to solve for our moonweight.

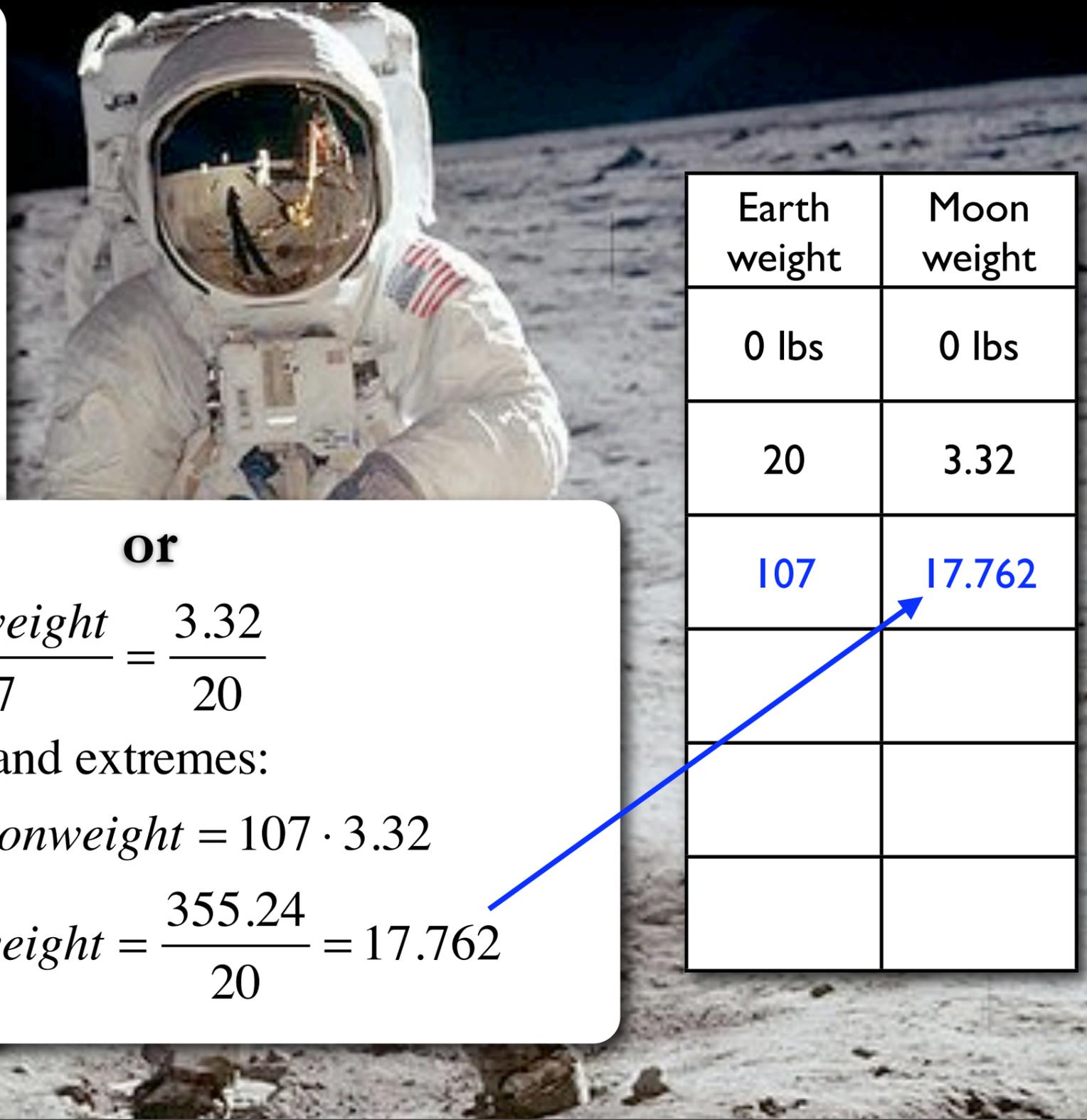
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Earth weight	Moon weight
0 lbs	0 lbs
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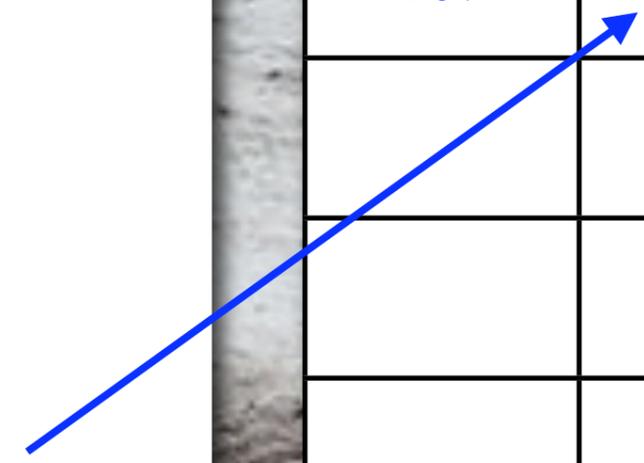
or

$$\frac{\text{Moonweight}}{107} = \frac{3.32}{20}$$

means and extremes:

$$20 \cdot \text{Moonweight} = 107 \cdot 3.32$$

$$\text{Moonweight} = \frac{355.24}{20} = 17.762$$



Solution: In this lesson, we will be “cross-multiply”-ing, that is, using means and extremes.

How long until the plane lands?



In this problem, we will look at a problem with a y -intercept and slope and then see that a proportion could solve it as well.

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?

(Small group discussion) Have students come to their own solutions, then have them share. There are multiple methods for solving this problem.

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?

starting point = 27000 feet high = y-intercept

constant change = -1500 feet/min = slope

Solution Method #1: slope-intercept equation

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?

starting point = 27000 feet high = y-intercept

constant change = -1500 feet/min = slope

$$x = \text{time passed} \quad y = -1500x + 27000$$

$$y = \text{height}$$

Solution Method #1: Equation set-up

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. **How long until the plane lands?**

starting point = 27000 feet high = y-intercept

constant change = -1500 feet/min = slope

$$x = \text{time passed} \quad 0 = -1500x + 27000$$

y = height

Solution Method #1: evaluated

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. **How long until the plane lands?**

starting point = 27000 feet high = y-intercept

constant change = -1500 feet/min = slope

$$\mathbf{x} = \text{time passed} \quad \mathbf{0} = -1500\mathbf{x} + 27000$$

$$\mathbf{y} = \text{height} \quad -27000 = -1500\mathbf{x}$$

Solution Method #1: solving

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?

starting point = 27000 feet high = y-intercept

constant change = -1500 feet/min = slope

$$x = \text{time passed} \quad 0 = -1500x + 27000$$

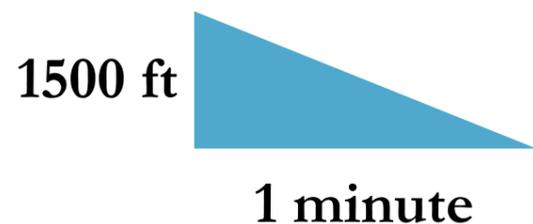
$$y = \text{height} \quad -27000 = -1500x \quad x = 18 \text{ min}$$

Solution Method #1: complete

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?

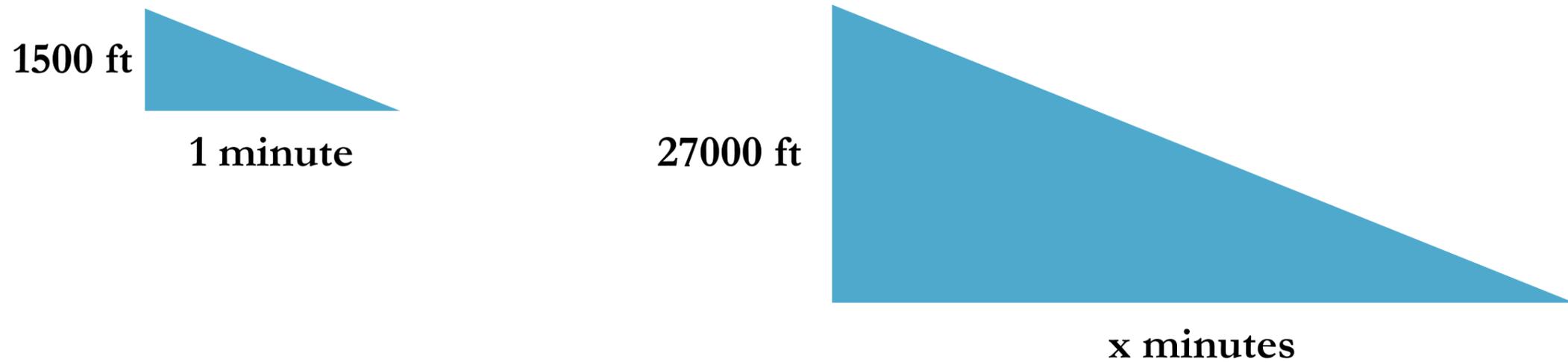


Solution method #2: Proportionality

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?

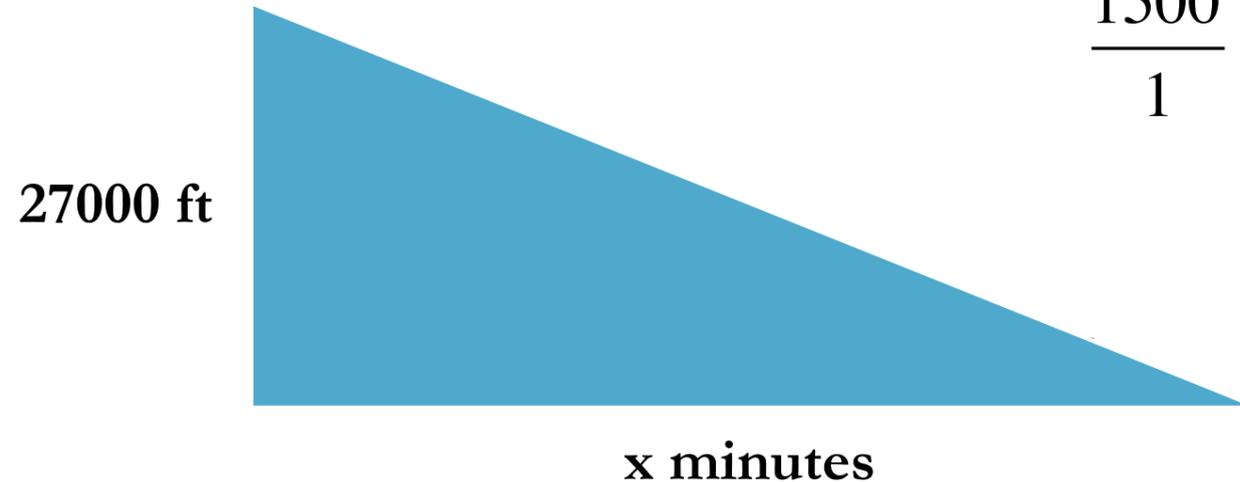
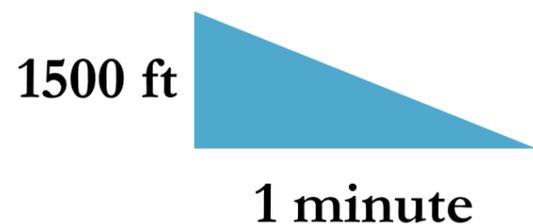


Solution method #2: Proportionality set-up

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?



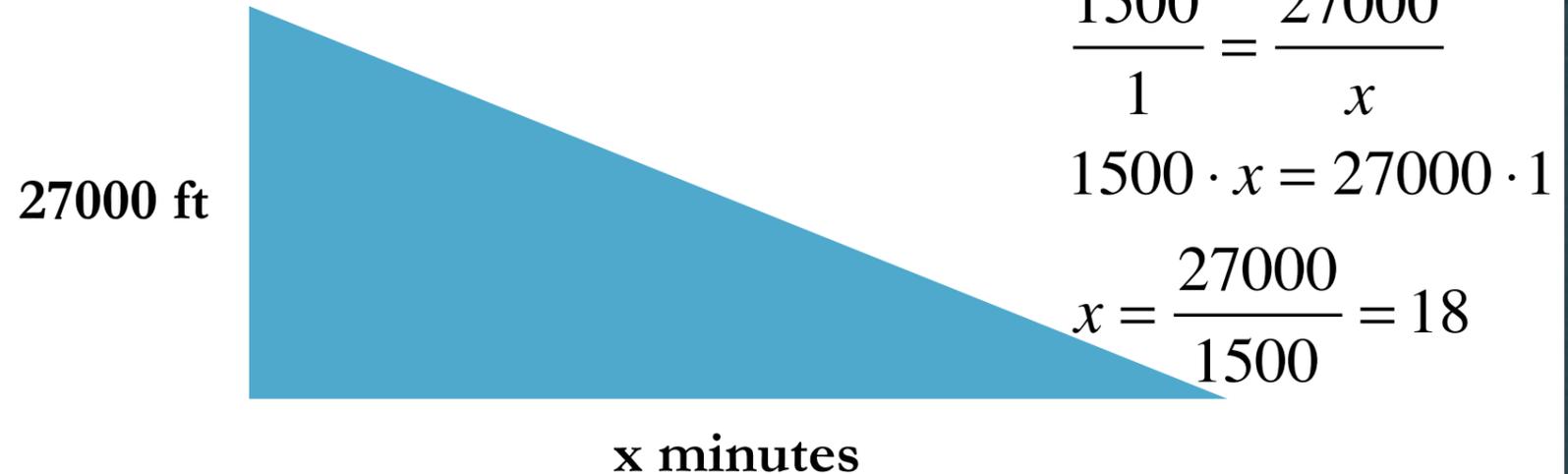
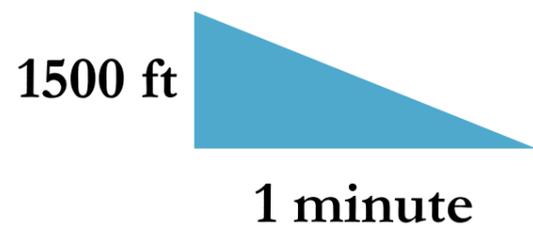
$$\frac{1500}{1} = \frac{27000}{x}$$

Solution method #2: Proportionality set-up

How long until the plane lands?



A plane is currently 27000 feet in the air, but is descending at 1500 feet per minute. How long until the plane lands?



$$\frac{1500}{1} = \frac{27000}{x}$$

$$1500 \cdot x = 27000 \cdot 1$$

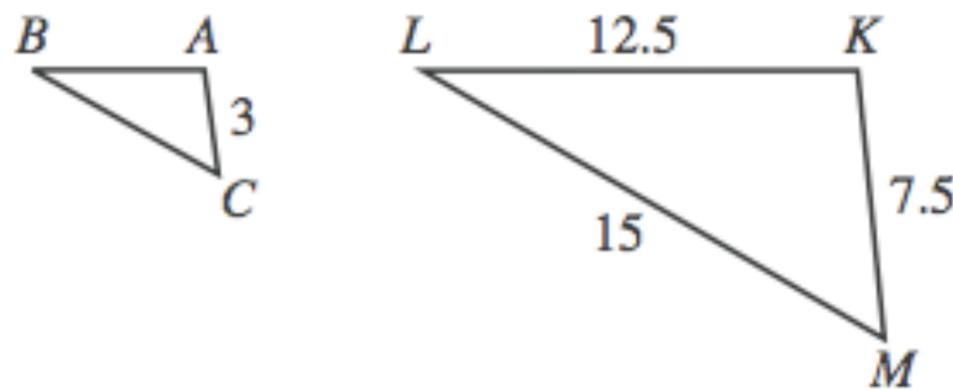
$$x = \frac{27000}{1500} = 18$$

It will take 18 minutes to land the plane.

Solution method #2: Proportionality solution

In the figure below, where $\triangle ABC \sim \triangle KLM$, lengths given are in centimeters. What is the perimeter, in centimeters, of $\triangle ABC$?

(Note: The symbol \sim means "is similar to.")

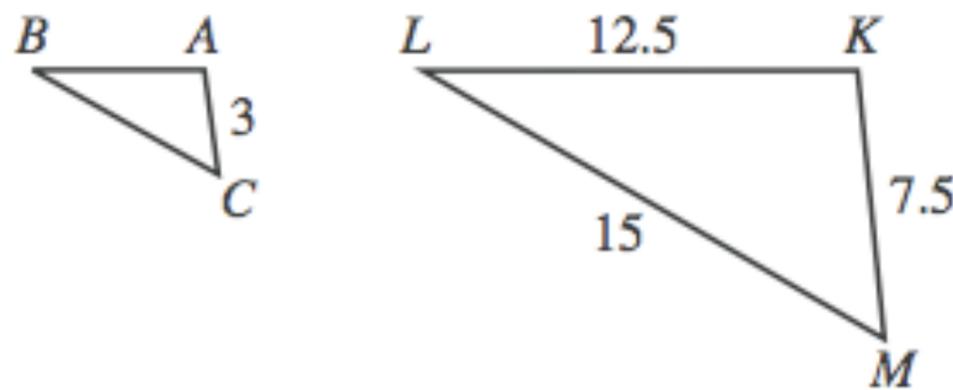


- A. 12
- B. 14
- C. $21\frac{1}{2}$
- D. 35
- E. $71\frac{3}{4}$

(Think, pair, share) Students have all information needed in order to solve the problem.

In the figure below, where $\triangle ABC \sim \triangle KLM$, lengths given are in centimeters. What is the perimeter, in centimeters, of $\triangle ABC$?

(Note: The symbol \sim means "is similar to.")



A. 12

B. 14

C. $21\frac{1}{2}$

D. 35

E. $71\frac{3}{4}$

$$\frac{\textit{small}}{\textit{big}} = \frac{3}{7.5}$$

OR

$$\textit{small} = \frac{3}{7.5} \cdot \textit{big}$$

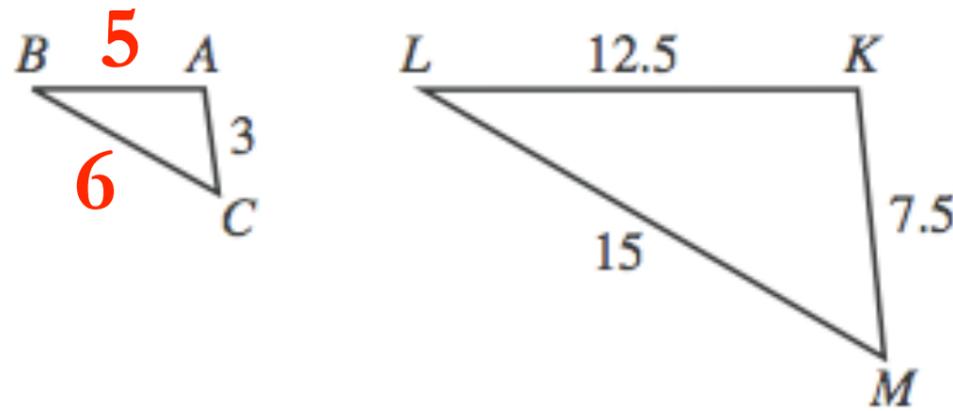
↓

$$\textit{small} = .4 \cdot \textit{big}$$

Solution. Equations set-up.

In the figure below, where $\triangle ABC \sim \triangle KLM$, lengths given are in centimeters. What is the perimeter, in centimeters, of $\triangle ABC$?

(Note: The symbol \sim means "is similar to.")



$$BC = .4 \cdot 15 = 6$$

$$AB = .4 \cdot 12.5 = 5$$

A. 12

B. 14

C. $21\frac{1}{2}$

D. 35

E. $71\frac{3}{4}$

$$\frac{\textit{small}}{\textit{big}} = \frac{3}{7.5}$$

OR

$$\textit{small} = \frac{3}{7.5} \cdot \textit{big}$$

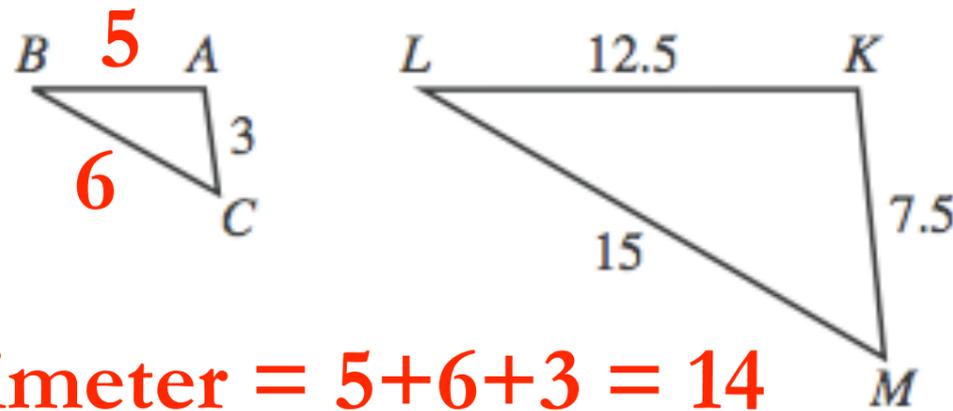
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$$\textit{small} = .4 \cdot \textit{big}$$

Solution. Sides found.

In the figure below, where $\triangle ABC \sim \triangle KLM$, lengths given are in centimeters. What is the perimeter, in centimeters, of $\triangle ABC$?

(Note: The symbol \sim means "is similar to.")



$$BC = .4 \cdot 15 = 6$$

$$AB = .4 \cdot 12.5 = 5$$

$$\text{perimeter} = 5 + 6 + 3 = 14$$

A. 12

B. 14

C. $21\frac{1}{2}$

D. 35

E. $71\frac{3}{4}$

$$\frac{\text{small}}{\text{big}} = \frac{3}{7.5}$$

OR

$$\text{small} = \frac{3}{7.5} \cdot \text{big}$$

↓

$$\text{small} = .4 \cdot \text{big}$$

Solution. Sides summed to find perimeter.

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Aldrin Apollo 11 original

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