Topic: Equation modeling

Question: A car and a truck were driven for a week. The car traveled 400 miles more than the truck. The fuel mileage for the car was 27 miles per gallon (mpg), and the fuel mileage for the truck was 18 mpg. Write an equation which gives the total amount of fuel, g (in gallons), that was used by the two vehicles that week in terms of c, the distance (in miles) traveled by the car.

	Car	Truck
Mileage	27 mpg	18 mpg
Distance	c miles	t miles

Answer choices:

A $g = \dfrac{5c - 1{,}200}{54}$

B $g = \dfrac{5c + 1{,}200}{54}$

C $g = \dfrac{c - 1{,}200}{18}$

D $g = \dfrac{c + 400}{27}$

Solution: A

Write an equation that gives the distance t (in miles) traveled by the truck in terms of c. We know that $c = t + 400$, so $t = c - 400$.

To get the amount of fuel used by each vehicle, divide its distance by its fuel mileage.

We'll replace "t miles" in the table with "$c - 400$ miles." Also, we'll add a row to the table, for the amounts of fuel used.

	Car	Truck
Mileage	27 mpg	18 mpg
Distance	c miles	t miles
Fuel used	c/27 gallons	(c-400)/18 gallons

We can write:

$$g = \frac{c}{27} + \frac{c - 400}{18}$$

$$g = \left(\frac{2}{2}\right)\frac{c}{27} + \left(\frac{3}{3}\right)\frac{c - 400}{18}$$

$$g = \frac{2c}{54} + \frac{3c - 1{,}200}{54}$$

$$g = \frac{2c + 3c - 1{,}200}{54}$$

$$g = \frac{5c - 1{,}200}{54}$$

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Question: The average speed of any falling object between time 0 (the time at which it starts falling) and time t is given by the ratio of the distance d through which it has fallen to the elapsed time (t), $V = D/t$. A ball is thrown at a speed of 12 ft/s straight downward from a tall cliff. The distance through which it has fallen is $D = 16t^2 + 12t$, where t is the time (in seconds) that it's been falling. Write an equation that gives t in terms of V.

Answer choices:

A $t = \dfrac{V + 12}{16}$

B $t = \dfrac{V}{28}$

C $t = \dfrac{V - 12}{16}$

D $t = \dfrac{V}{4}$

Solution: C

Start with $V = D/t$, and substitute $16t^2 + 12t$ for D.

$$V = \frac{16t^2 + 12t}{t}$$

Simplify, and then solve for t.

$$V = 16t + 12$$

$$t = \frac{V - 12}{16}$$

Topic: Equation modeling

Question: At a movie theater, prices are $\$4$ for children and $\$8$ for adults. If 800 people came to see a movie, write an equation that gives the number of children, c, in terms of T, the total amount of money taken in.

Answer choices:

A $c = \frac{T}{4} - 1{,}600$

B $c = 1{,}600 - 4T$

C $c = 6{,}400 + 8T$

D $c = 1{,}600 - \frac{T}{4}$

Solution: D

Let c be the number of children and a the number of adults. The total money taken in is

$$T = 4c + 8a$$

We also know that the total number of people who came to see the movie is 800, that is, $c + a = 800$. So $a = 800 - c$. Substituting $800 - c$ for a in the equation $T = 4c + 8a$ gives

$$T = 4c + 8(800 - c)$$

$$T = 4c + 6{,}400 - 8c$$

$$T = -4c + 6{,}400$$

Now solve for c.

$$T + 4c = 6{,}400$$

$$4c = 6{,}400 - T$$

$$c = 1{,}600 - \frac{T}{4}$$