

**Topic:** Equations with subscripts

**Question:** The pressure and volume of a gas are related by  $P_1V_1 - P_2V_2 = 0$ , where  $P_1$  and  $V_1$  are the original pressure and volume and  $P_2$  and  $V_2$  are the new pressure and volume. If the original pressure is 1.2, the original volume is 150, and the new pressure is 36, what is the new volume?

**Answer choices:**

- A  $V_2 = 0.2$
- B  $V_2 = 0.288$
- C  $V_2 = 3.47$
- D  $V_2 = 5$



**Solution: D**

We know  $P_1 = 1.2$ ,  $V_1 = 150$ , and  $P_2 = 36$ . Substituting these values into the equation that relates them gives

$$P_1 V_1 - P_2 V_2 = 0$$

$$1.2(150) - 36(V_2) = 0$$

$$180 - 36V_2 = 0$$

Use inverse operations to solve for  $V_2$ .

$$180 - 36V_2 + 36V_2 = 0 + 36V_2$$

$$180 = 36V_2$$

$$\frac{180}{36} = \frac{36V_2}{36}$$

$$5 = V_2$$

$$V_2 = 5$$



**Topic:** Equations with subscripts

**Question:** A car travels at 60 mph for 135 miles, then speeds up and travels at a new constant speed for another 216 miles. If the total time for the trip is 5.25 hours, how fast does the car travel during the second part of the trip? Use  $d_1$  and  $d_2$  as the first distance and the second distance,  $v_1$  and  $v_2$  as the first speed and the second speed, and  $t$  as the total time for the trip.

$$\frac{d_1}{v_1} + \frac{d_2}{v_2} = t$$

**Answer choices:**

- A      70 mph
- B      72 mph
- C      74 mph
- D      76 mph



**Solution: B**

We're starting with  $d_1 = 135$ ,  $d_2 = 216$ ,  $v_1 = 60$ , and  $t = 5.25$ , and we need to solve for  $v_2$ . Plug these values into the equation that relates them.

$$\frac{d_1}{v_1} + \frac{d_2}{v_2} = t$$

$$\frac{135}{60} + \frac{216}{v_2} = 5.25$$

Use inverse operations to isolate  $v_2$ .

$$\frac{135}{60} - \frac{135}{60} + \frac{216}{v_2} = 5.25 - \frac{135}{60}$$

$$\frac{216}{v_2} = 5.25 - 2.25$$

$$\frac{216}{v_2} = 3.00$$

$$\frac{216}{v_2} v_2 = 3.00 v_2$$

$$216 = 3.00 v_2$$

$$\frac{216}{3.00} = \frac{3.00 v_2}{3.00}$$

$$v_2 = 72$$



**Topic:** Equations with subscripts

**Question:** A house has three grassy yards. The dimensions of the front yard are  $l_f = 50$  ft by  $w_f = 22$  ft. The side yard is  $l_s = 40$  ft by  $w_s = 12$  ft, and the back yard is  $l_b = 50$  ft by an unknown  $w_b$ . If the total grassy area is 3,180  $\text{ft}^2$ , what is the width of the back yard?

$$A = l_f w_f + l_s w_s + l_b w_b$$

**Answer choices:**

- A      32 ft
- B      51.2 ft
- C      76 ft
- D      95.2 ft



**Solution: A**

Plugging everything we've been given into the formula for total area gives

$$A = l_f w_f + l_s w_s + l_b w_b$$

$$3,180 = 50(22) + 40(12) + 50(w_b)$$

$$3,180 = 1,100 + 480 + 50w_b$$

$$3,180 = 1,580 + 50w_b$$

Use inverse operations to isolate  $w_b$ .

$$3,180 - 1,580 = 1,580 - 1,580 + 50w_b$$

$$1,600 = 50w_b$$

$$\frac{1,600}{50} = \frac{50w_b}{50}$$

$$\frac{1,600}{50} = w_b$$

$$w_b = 32$$

