

Inverse Variation

1) The fan pulley and an alternator pulley are connected by a fan belt on an automobile engine. The fan pulley is 225 cm in diameter and the alternator pulley is 125 cm in diameter. If the fan pulley turns at 500 rpm, how many revolutions per minute does the faster alternator pulley turn?

Known fact 225 cm fan pulley turns at 500 rpm
 Unknown fact 125 cm alt. pulley turns at x rpm
 Estimation alt. pulley is around $\frac{1}{2}$ the size, it turns twice as fast, so around 1000 rpm

$$\frac{225}{125} = \frac{x}{500}$$

$$125x = 112,500$$

$$x = 900$$

alt. pulley turns at 900 rpm

2) The volume of a certain gas is inversely proportional to the pressure on it. If the gas has a volume of 160 in³ under pressure of 20 lb per square inch (psi), what is the volume if the pressure is decreased to 16 psi?

Known 20 psi has a volume of 160 in³
 16 psi has a volume of x in³

Est 16 psi should have more volume over 160 in³

$$\frac{20}{16} = \frac{x}{160}$$

$$16x = 3200$$

$$x = 200$$

16 psi has a volume of 200 in³

3) A pulley that measures 15 in. across (diameter) turns at 1600 rpm and drives a larger pulley at the rate of 1200 rpm. What is the diameter of the larger pulley in this inverse relationship?

15 in turns at 1600 rpm
 x in turns at 1200 rpm

Estimation 30 in turns half the speed 800 rpm the pulley is between 15 and 30 in

$$\frac{15}{x} = \frac{1600}{1200}$$

$$1200x = 24000$$

$$x = 20 \text{ in}$$

20 in pulley turns at 1200 rpm

4) Six painters can trim the exterior of all the new brick homes in a subdivision in 9 weeks. The contractor wants to have the home ready in just 3 weeks and so he needs more painters. How many painters are needed for a job if they all work at the same rate?

6 painters takes 9 weeks
 x painters takes 3 weeks

triple the painters
 18 painters

$$\frac{6}{x} = \frac{9}{3}$$

$$3x = 54$$

$$x = 18$$

18 painters are needed for 3 weeks

so he needs 18 painters

5) Two groundskeepers take 25 h to prepare a golf course for a tournament. How long will it take five groundskeepers to prepare the golf course?

2 groundskeepers takes 25 hr
 5 groundskeepers takes x hr

6 groundkeepers will take about 8 hrs
 5 should be over 8 hrs

$$\frac{2}{5} = \frac{x}{25}$$

$$5x = 50$$

$$x = 10$$

5 take 10 hrs

6) A gear measures 5 in. across. It turns another gear 2.5 in. across. If the larger gear has a speed of 25 rpm, what is the speed of the smaller gear?

5 in gear turns at 25 rpm
 2.5 in gear turns at x rpm
 Should turn twice as fast,
 so 50 rpm

$$\frac{5}{2.5} = \frac{x}{25}$$

$$2.5x = 125$$

$$x = 50$$

Smaller gear turns at 50 rpm

7) A small pulley 3 in. in diameter turns 250 rpm and drives a pulley at 150 rpm. What is the diameter (distance across) of the larger pulley?

3 in turns at 250 rpm
 x in turn at 150 rpm
 6 in will turn a 125 rpm
 so a little less than 6 in

$$\frac{3}{x} = \frac{150}{250}$$

$$150x = 750$$

$$x = 5 \text{ in}$$

5 in turns at 150 rpm

8) Two painters painting at the same speed can paint 800 ft² of wall space in 6 h. If a third painter paints at the same speed, how long will it take all three painters paint the wall space?

2 painters paint space in 6 hrs
 3 painter paint space in x hrs
 1 painter will take 12 hrs
 3 painters will take 4 hrs

$$\frac{2}{3} = \frac{x}{6}$$

$$3x = 12$$

$$x = 4$$

3 painters will take 4 hours

9) Three machines complete a printing project in 5 h. How many machines are needed to finish the same project in 3 h?

3 machines take 5 hrs
 x machines take 3 hrs
 6 machines take 2.5 hrs
 so less than 6 machines

$$\frac{3}{x} = \frac{3}{5}$$

$$3x = 15$$

$$x = 5$$

5 machines take 3 hrs

10) A gear measures 6 in. across. It is in mesh with another gear with a 3 in. diameter. If the larger gear has a speed of 60 rpm, What is the rpm of the smaller gear?

6 in gear turns at 60 rpm
 3 in gear turns at x rpm
 3 in gears should turn at 120 rpm

$$\frac{6}{3} = \frac{x}{60}$$

$$3x = 360$$

$$x = 120$$

3 in gear turns at 120 rpm