Inverse Proportion: *As one quantity increases, another decreases.*

**Examples:** …………………………A Volume of gas decreases as Pressure increases. …….The time it takes to do a job decreases as the number of people working increases.

1. When two quantities are inversely proportional, the two *equal* ratios are in *inverse* order.
2. Each ratio has the same units of measure.

\[
y = \frac{1}{x}
\]

As \(x\) increases, \(y\) decreases.

**Examples:**

\[
\begin{align*}
7 \text{ people (work 15 h)} & = 21 \text{ h} \\
5 \text{ people (work 21 h)} & = 15 \text{ h}
\end{align*}
\]

\[
\begin{align*}
20 \text{ candelas @ 3 m} & = 4 \text{ m} \\
15 \text{ candelas @ 4 m} & = 3 \text{ m}
\end{align*}
\]

**Notice:** ● the ratios are equal ● each ratio has the same units

Is the question a direct or inverse proportion? Ask yourself whether one part increases as another decreases.

**Example question:**

Boyle’s law states that if temperature (\(T\)) is held constant, the volume (\(V\)) of a gas decreases as pressure (\(P\)) increases.

\[
PV = k \quad \text{OR} \quad P = \frac{k}{V} \quad \text{OR} \quad P \propto \frac{1}{V}
\]

The volume of a certain gas is 3.2 m³ under an applied pressure of 169 Pa. If the pressure is increased to 240 Pa, what is the reduced volume of the gas? (Pa – *pascal* – is the SI unit for pressure.)

\[
P_1V_1 = P_2V_2 \quad \text{Given:} \quad P_1 = 169 \text{ Pa} \quad V_1 = 3.2 \text{ m}^3 \quad P_2 = 240 \text{ Pa} \quad \text{Find:} \quad V_2
\]

\[
\frac{P_1V_1}{P_2} = V_2 \quad \therefore \quad V_2 = \frac{(169 \text{ Pa})(3.2 \text{ m}^3)}{240 \text{ Pa}} = 2.3 \text{ m}^3
\]
Questions:

1. The pressure on 208 in$^3$ of air in a cylinder is 31.2 psi (lb/in$^2$). What is the pressure when the volume is decreased to 54 in$^3$?

2. A pulley with a diameter of 25 cm rotates at 1200 r/min and drives a smaller pulley which turns at 2000 r/min. What is the diameter of the smaller pulley?

3. If it takes four workers 21 days to finish a job, how many workers (working at the same rate) would it take to finish the job in 12 days?

4. A particular job can be completed in 8 weeks if 12 machines are used. How many machines are necessary to complete the job in 6 weeks?

5. The larger gear (below) has a diameter of 25 cm. The diameter of the small gear is 15 cm. If the small gear revolves at 1500 rev/min, how many revolutions per minute does the larger gear turn per minute?

Answers:

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<tbody>
<tr>
<td>1.</td>
<td>120 psi</td>
<td>2.</td>
<td>15 cm</td>
<td>3.</td>
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