Formula Manipulation Practice Name: Solutions

1. Using the formula $v = \frac{d}{t}$ determine v in each of the following cases with attention to units and significant figures.

a. $d = 5.0$ metres $t = 12$ seconds

$v = \frac{d}{t} = \frac{5.0 \text{ metres}}{12 \text{ seconds}} = 0.41666\ldots \text{ m/s} \approx 0.42 \text{ m/s}$ ← rounded to 2 sig figs

b. $d = 5$ metres $t = 12$ seconds

$v = \frac{d}{t} = \frac{5 \text{ metres}}{12 \text{ seconds}} = 0.41666\ldots \text{ m/s} \approx 0.4 \text{ m/s}$ ← rounded to 1 sig fig

c. $d = \cancel{12.0}\ 5.0$ miles $t = \cancel{0.52}\ 12$ hours

$v = \frac{d}{t} = \frac{5.0 \text{ miles}}{12 \text{ hours}} = 0.41666 \text{ miles/hr} \approx 0.42 \text{ miles/hr}$

d. $d = 560$ kilometres $t = 13$ hours

$v = \frac{d}{t} = \frac{560 \text{ Km}}{13 \text{ hr}} = 43.0769\ldots \text{ Km/hr} \approx 43 \text{ Km/hr}$ ← 2 sig figs

e. $d = 34$ furlongs $t = 3$ days

$v = \frac{d}{t} = \frac{34 \text{ furlongs}}{3 \text{ days}} = 11.333\ldots \text{ Furlongs/day} \approx 10 \text{ Furlongs per day}$

↑ 1 sig fig

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2. Using the formula $d = vt$ determine d in each of the following cases with attention to units and significant figures.

a. $v = 5.1$ metres/sec $t = 12$ seconds

$d = vt = 5.1 \frac{\text{metres}}{\text{sec}} \times 12 \text{ sec} = 61.2 \text{ m}$

$\approx 61 \text{ m}$

b. $v = 19$ metres/sec $t = 5$ seconds

$d = vt = 19 \frac{\text{metres}}{\text{sec}} \times 5 \text{ sec} = 95 \text{ m}$

$\approx 100 \text{ m}$ ← 1 sig fig

c. $v = 63$ miles/hour $t = 0.52$ hours

$d = vt = 63 \frac{\text{miles}}{\text{hr}} \times 0.52 \text{ hr} = 32.76 \text{ miles}$

$\approx 33 \text{ miles}$

d. $v = 56$ kilometres/hour $t = 13$ hours

$d = vt = 56 \frac{\text{km}}{\text{hr}} \times 13 \text{ hr} = 728 \text{ km}$

$\approx 730 \text{ km}$

e. $v = 34$ furlongs per day $t = 9$ days

$d = vt = 34 \frac{\text{furlongs}}{\text{day}} \times 9 \text{ days} = 306 \text{ furlongs}$

$\approx 300 \text{ furlongs}$

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3. Consider the formula $d = vt$

   a. Rearrange it to make t the subject.

$$d = vt$$
$$\div v \quad \div v$$
$$\frac{d}{v} = t$$

   b. Determine the value of t when $d = 4.8$ meters and $v = 0.234$ meters/second.

$$t = \frac{d}{v} = \frac{4.8\ m}{0.234\ \frac{m}{s}} = 20.5128\ sec \approx 21\ sec$$

Units: $\frac{m}{\frac{m}{sec}} = m \times \frac{sec}{m} = sec$

Dividing is the same as multiply by reciprocal of fraction

4. Consider the formula $v_f = v_0 + at$

   a. Rearrange it to make v_0 the subject.

$$V_f = V_0 + at$$
$$-at \quad -at$$
$$V_f - at = V_0$$

   b. Rearrange it to make a the subject.

$$V_f = V_0 + at$$
$$-V_0 \quad -V_0$$
$$V_f - V_0 = at$$
$$\div t \quad \div t$$
$$\frac{V_f - V_0}{t} = a$$

   c. Rearrange it to make t the subject.

$$V_f = V_0 + at$$
$$-V_0 \quad -V_0$$
$$V_f - V_0 = at$$
$$\div a \quad \div a$$
$$\frac{V_f - V_0}{a} = t$$

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5. Consider the formula $v_f^2 = v_0^2 + 2ad$

   a. Rearrange it so v_f not v_f^2 is the subject.

$$V_f = \pm\sqrt{V_0^2 + 2ad}$$

need to consider the positive AND negative roots

   b. Rearrange it so v_o is the subject.

$V_f^2 = V_0^2 + 2ad$

$-2ad \quad -2ad$

$V_f^2 - 2ad = V_0^2$

$\pm\sqrt{V_f^2 - 2ad} = V_0$

   c. Rearrange it so a is the subject.

$V_f^2 = V_0^2 + 2ad$

$-V_0^2 \quad -V_0^2$

$V_f^2 - V_0^2 = 2ad$

$\div 2 \quad \div 2$

$\frac{V_f^2 - V_0^2}{2} = ad$

$\div d \quad \div d$

$\frac{V_f^2 - V_0^2}{2d} = a$

   d. Rearrange it so d is the subject.

$V_f^2 = V_0^2 + 2ad$

$-V_0^2 \quad -V_0^2$

$V_f^2 - V_0^2 = 2ad$

$\div 2a \quad \div 2a$

$\frac{V_f^2 - V_0^2}{2a} = d$

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6. Consider the formula $E_p = mgh$
   a. Rearrange it to make m the subject.

$E_p = mgh$
$\div g \quad \div g$
$\frac{E_p}{g} = mh$
$\div h \quad \div h$
$\frac{E_p}{gh} = m$

   b. Rearrange it to make g the subject.

$E_p = mgh$
$\div mh \quad \div mh$
$\frac{E_p}{mh} = g$

   c. Rearrange it to make h the subject.

$E_p = mgh$
$\div mg \quad \div mg$
$\frac{E_p}{mg} = h$

7. Consider the formula $E_k = \frac{1}{2}mv^2$
   a. Rearrange it to make m the subject.

$E_k = \frac{1}{2}mv^2$
$\times 2 \quad \times 2$
$2E_k = mv^2$
$\div v^2 \quad \div v^2$
$\frac{2E_k}{v^2} = m$

   b. Rearrange it to make v the subject.

$E_k = \frac{1}{2}mv^2$
$\times 2 \quad \times 2$
$2E_k = mv^2$
$\div m \quad \div m$
$\frac{2E_k}{m} = v^2$
$\pm\sqrt{\frac{2E_k}{m}} = v$