KEY

CALCULATING MOTION

Directions: Calculate the missing variables for each question below. You must show your work. Follow the 5 step method to problems solving.

1. What is the velocity of a frog that jumps 27 feet in the air for 2.75 seconds?

$v = \frac{d}{t}$

$v = ?$, $d = 27\,ft$, $t = 2.75\,s$

$v = \frac{d}{t} = \frac{27\,ft}{2.75\,s} =$ **9.81 ft/s**

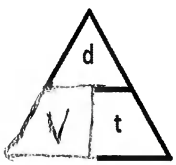
2. What is the velocity of a ball that is thrown in the air 16 meters? The ball reaches the ground in 25 seconds.

$v = \frac{d}{t}$

$v = ?$, $d = 16\,m$, $t = 25\,s$

$v = \frac{d}{t} = \frac{16\,m}{25\,s} =$ **0.64 m/s**

3. What is the distance from Langhorne to Newtown if the car is traveling 35 miles/hr up Rt.413 for 0.12 seconds? (THINK ABOUT WHAT YOU ARE SOLVING FOR)



$d = ?$

$V = \frac{35\,mi}{hr} \times \frac{1\,hr}{60\,min} \times \frac{1\,min}{60\,sec} = 0.01\,mi/s$

$t = 0.12\,s$

$d = vt = 0.01\,\frac{mi}{s} \times 0.12\,s$

$= 0.0012$ **miles**

4. The velocity of a car was increased from 87 m/sec. to 110 m/sec. in 8 seconds. Calculate acceleration.

$a = \frac{v_F - v_i}{t}$

$a = ?$ $t = 8\,s$, $V_f = 110\,m/s$, $V_i = 87\,m/s$

$a = \frac{(V_f - V_i)}{t} = \frac{(110\,m/s - 87\,m/s)}{8\,s} = \frac{23\,m/s}{8\,s} =$ **2.87 m/s^2**

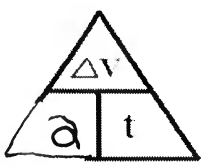
5. A car traveled down the highway at 39 miles/hr. After the great patience, the driver decided to pass and accelerated to 55 miles/hr. This acceleration took 6 seconds. Calculate the acceleration.

$a = \frac{v_F - v_i}{t}$

$a = ?$, $V_f = 55\,mi/hr$, $V_i = 39\,mi/hr$, $t = 6\,s$

$a = \frac{(V_f - V_i)}{t} = \frac{(55\,mi/hr - 39\,mi/hr)}{6\,s} =$ **2.67 mi/hr/s**

6. How much time does it take a go-cart to accelerate to 15 m/sec^2 if the total velocity change was 30 m/sec? Calculate the time.



$t = ?$

$a = 15\,m/s^2$

$\Delta V = 30\,m/s$

$t = \frac{\Delta V}{a} = \frac{30\,m/s}{15\,m/s^2} =$ **2.0 s**

$1\,kg \cdot m/s^2 = 1\,N$

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7. For each of the cases below, tell which object would require the greater **force** to achieve the acceleration given. A 10 kg mass with an acceleration of 10 m/sec/sec or a 15 kg mass with an acceleration of 6 m/sec/sec.

$F_{net} = m \times a$

$F = ?$, $m = 10\,kg$, $a = 10\,m/s^2$ | $F = m \cdot a$ | $F = 10\,kg \cdot 10\,m/s^2$ | $F = 100\,N$

$F = ?$, $m = 15\,kg$, $a = 6\,m/s^2$ | $F = m \cdot a$ | $F = 15\,kg \cdot 6\,m/s^2$ | $F = 90\,N$

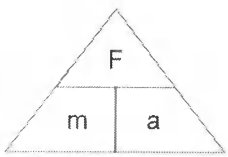
8. For each of the cases below, tell which object would require the greater force to achieve the acceleration given. An 18 kg mass with an acceleration of 9 m/sec/sec or an 11 kg mass with an acceleration of 15 m/sec/sec.

$F_{net} = m \times a$

$F = ?$, $m = 18\,kg$, $a = 9\,m/s^2$ | $F = ma$ | $F = 18\,kg \cdot 9\,m/s^2$ | $F = 162\,N$

$F = ?$, $m = 11\,kg$, $a = 15\,m/s^2$ | $F = m \cdot a$ | $F = 11\,kg \cdot 15\,m/s^2$ | $F = 165\,N$

9. For each of the cases below, tell which object would develop the greater **acceleration** after receiving the force given. A 2 kg mass with 10 N of force applied or a 3 kg mass with 6 N of force applied.



$a = \frac{F}{m} = \frac{10\,N}{2\,kg} = 5\,m/s^2$

$a = ?$, $F = 10\,N$, $m = 2\,kg$

$a = \frac{F}{m} = \frac{6\,N}{3\,kg} = 2.0\,m/s^2$

$a = ?$, $F = 6\,N$, $m = 3\,kg$

TRY THIS!

10. A car going 10m/s accelerates at $2m/s^2$ for 8s. What is the car's final velocity?

$V_i = 10\,m/s$, $a = 2\,m/s^2$, $t = 8\,s$, $V_f = ?$

$t \cdot a = \frac{(V_f - V_i)}{t} \cdot t$

$V_f - V_i = (at) + V_i$

$+V_i$

$V_f = (at) + V_i$

$V_f = (2\,m/s^2 \cdot 8\,s) + 10\,m/s$

$V_f = 26\,m/s$

11. A 1000kg car going 10m/s downshifts and applies a force of 200N for 20s. What is the final velocity of the car?

$m = 1000\,kg$, $V_i = 10\,m/s$, $F = 200\,N$, $t = 20\,s$, $a = ?$ $V_f = ?$

$F = ma$

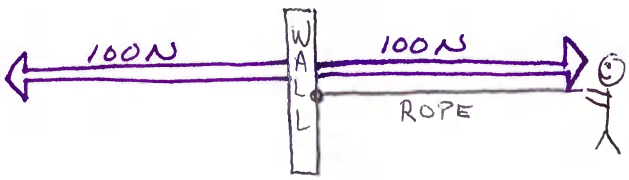
$a = \frac{(V_f - V_i)}{t}$

$a = \frac{F}{m} = \frac{200\,N}{1000\,kg} = 0.2\,m/s^2$ acceleration

$V_f = (at) + V_i = (0.2\,m/s^2 \cdot 20\,s) + 10\,m/s$

$V_f = 4\,m/s + 10\,m/s = 14\,m/s$

12. One person is having a tug-o-war with a rope attached to a wall. Draw and label the force (strength and direction) at each end of the rope.



Equal Force in opposite direction