The Laws of Motion

/20

Name: _____ Date: _____

$v_2 = v_1 + a\Delta t$ $\Delta d = v_1\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta d = \left(\frac{v_1+v_2}{2}\right)\Delta t$

$v_2^2 = v_1^2 + 2a\Delta d$ $\Delta d = v_2\Delta t - \frac{1}{2}a\Delta t^2$ $F = ma$

Solve each of the problems below; you may use Newton's Second Law and kinematics equations to solve the problems. Work collaboratively with your classmates to solve these problems.

1. [5 marks] A physics student accelerates a 1.3 kg toy car along a track. Using a motion sensor the student measures the change in speed at two points over a 25 cm distance on the track. The time at the first point was 1.56 m/s and at the second point it was 0.95 m/s. Calculate the force required to produce this acceleration.

$\Sigma F = Ma$

$= (1.3)(-3.062)$

$\Sigma F = -4\ N$ ✓

$v_2^2 = v_1^2 + 2a\Delta d$

$a = \frac{v_2^2 - v_1^2}{2\Delta d}$

$= \frac{(0.95)^2 - (1.56)^2}{2(0.25)}$

$a = -3.062\ m/s/s$

2. [5 marks] A car experiences a force of 1200 N of force for 18 seconds. The mass of the car is 800 kg. If the car started from a speed of 5 m/s, calculate how fast it would it be going after the 18 seconds?

$\Sigma F = Ma$

$a = \frac{\Sigma F}{M} = \frac{1200\ N}{800\ kg}$

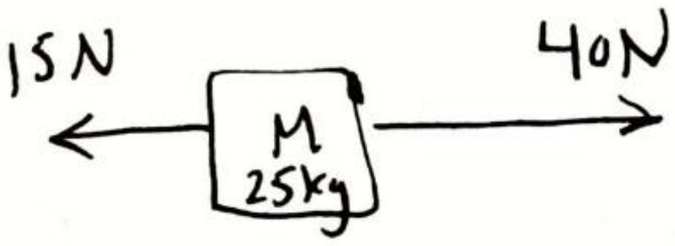
$a = 1.5\ m/s/s$

$v_2 = v_1 + a\Delta t$

$= (5) + (1.5)(18)$

$v_2 = 32\ m/s$ ✓

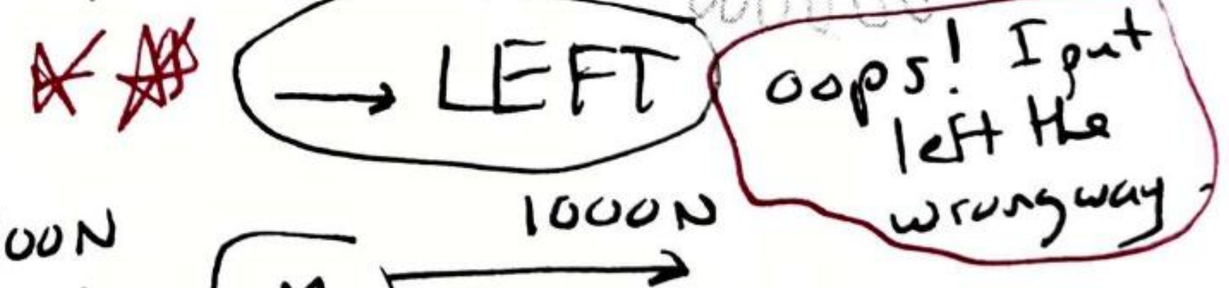
3. [5 marks] Matrix the Monkey is on a skateboard resting on the level ground. He is being pulled by two ropes. One rope pulls with a force of 40 N to the right and a force of 15 N pulls on him to the left. If Matrix the Monkey has a mass of 25kg calculate the acceleration (size and direction) that *MtM* experiences.



$$\Sigma F = 40\,N - 15\,N$$
$$= 25\,N \text{ [right]}$$

$$\Sigma F = ma$$
$$a = \frac{\Sigma F}{m}$$
$$= \frac{25\,N}{25\,kg}$$
$$a = 1\,m/s/s$$

4. [5 marks] There are three independent horizontal forces acting on Hexa-Digital. Hexa-D has a mass of 600 kg. Determine a three force combination (size and direction) that would cause Hexa-D to accelerate at 3 m/s/s to the left. Once completed list at least two other three-force combinations that would result in this acceleration. Share and compare with your classmates to see how many different combinations were made.



$$\Sigma F = ma$$
$$= (600)(3)$$
$$\Sigma F = 1800\,N \text{ [left]}$$