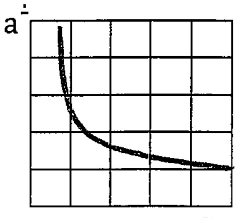
Patterns in Force and Interactions:

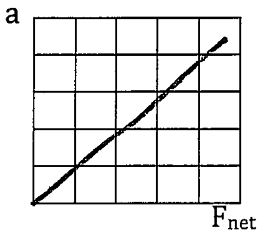
Force: $a = \frac{\Sigma F}{m}$

Friction:

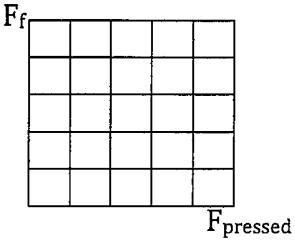
1. Graphically



$\Sigma F = 10N$



$m = 2 kg$



2.Mathematically

$a = \frac{\Sigma F}{m}$

$\boxed{a = \frac{10}{m}}$

$a = \frac{\Sigma F}{m}$

$\boxed{a = \frac{\Sigma F}{2}}$

$F_f =$

3. Data Tables: when *needed* assume a constant force of 5 N, a constant mass of 10 kg and stickiness factor of 0.5:

m	a
1	10
2	5
5	2

F_{net}	a
1	0.5
2	1
5	2.5

$F_{pressed}$	F_f
1	
2	
5	

In words:

as mass increases, accelaration decreses

in words:

as Fnet increases, acceleration decreses

in words:

Find 2 significant differences between the a vs F_{net} & the a vs m graphs above:

1.

2.

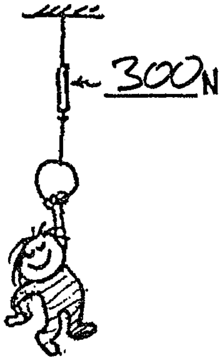
What does the slope in the F_f vs $F_{pressed}$ graph above stand for?

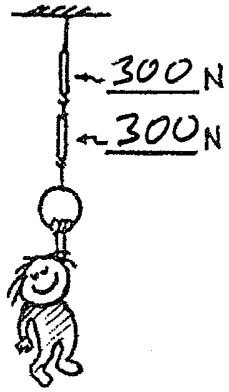
What does the slope in the a vs Fnet graph above stand for?

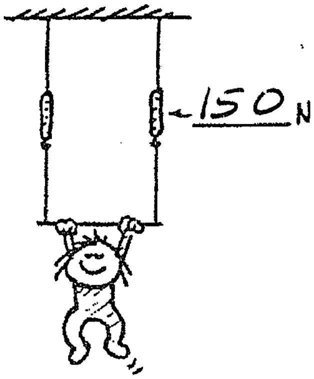
Concept-Development Practice Page 4-2

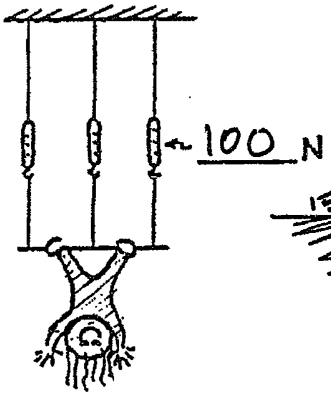
Statics

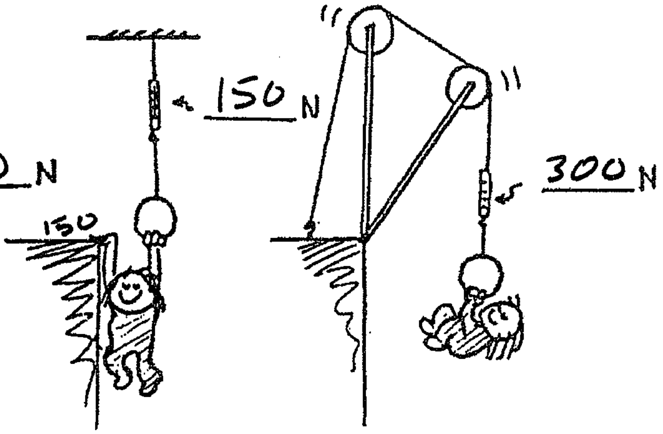
1. Little Nellie Newton wishes to be a gymnast and hangs from a variety of positions as shown. Since she is not accelerating, the net force on her is zero. This means the upward pull of the rope(s) equals the downward pull of gravity. She weighs 300 N. Show the scale reading for each case.

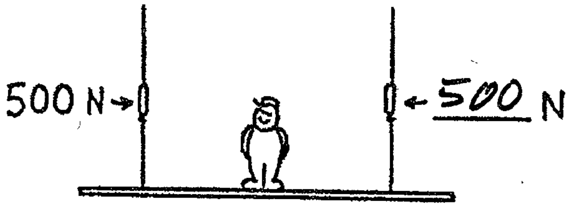




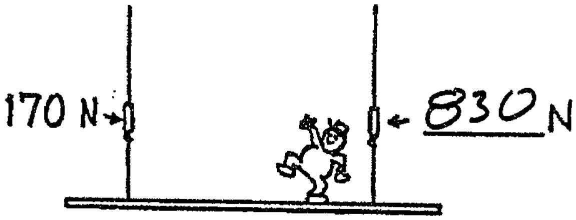




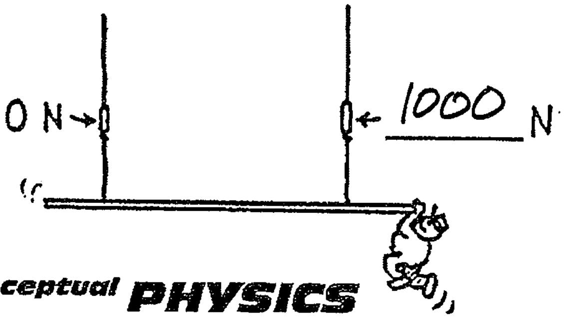




2. When Burl the painter stands in the exact middle of his staging, the left scale reads 500 N. Fill in the reading on the right scale. The total weight of Burl and staging must be
1000 N.



3. Burl stands farther from the left. Fill in the reading on the right scale.



4. In a silly mood, Burl dangles from the right end. Fill in the reading on the right scale.

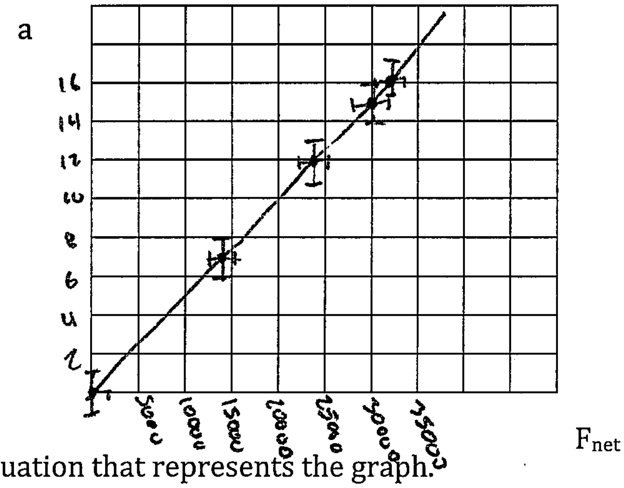
Generating and Analyzing Graphs of F_{net}

Using the information provided in each problem fill out the data table, graph the data on the graphs provided, and then sketch in your simplest best-fit line.

1. A stunt airplane (mass = 2000 kg) fires its engine at max force of 32000 N, in order to take off; as it speeds up it reaches speeds that incur significant air resistance as it takes-off as shown below.

Time (s) +/- 0.5	Force of Engine (N) +/- 100	Force of Air Resistance (N) +/- 100	F_{net} (N) +/- 200	Acceleration (m/s^2) +/- 1
0.0	32000	0	32000	16
5.0	32000	- 2000	30000	15
10.0	32000	- 8000	24000	12
15.0	32000	- 18000	14000	7
20.0	32000	- 32000	0	0

$a = \frac{\Sigma F}{2000\,kg}$



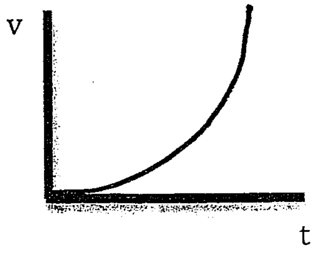
a) Write the equation that represents the graph.

$a = \frac{\Sigma F}{2000\,kg}$

*b) When the air resistance is equal in size to the thrust of the stunt airplane, the plane reaches its highest speed – also called, terminal velocity. At what time did the stunt airplane reach terminal velocity?

t = 20.0 s

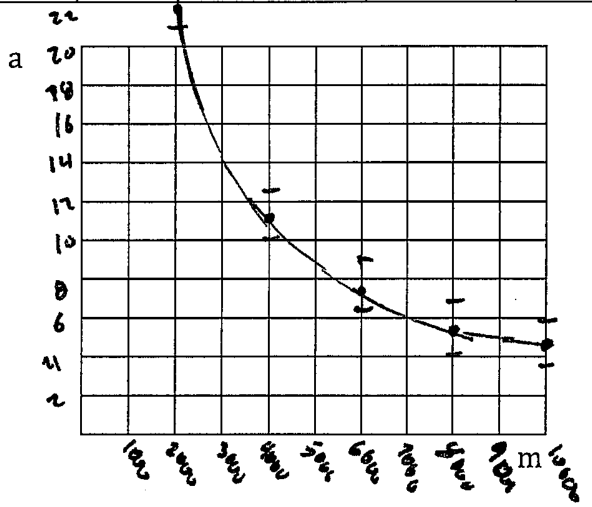
*c) Using your understanding of motion, acceleration, and forces, sketch what the velocity vs time graph would look like for the stunt plane for the first thirty seconds of flight:



2. A rocket during take-off actually burns and expels enough of its fuel to significantly change the rocket's overall mass. So while the force of the rocket (called thrust) stays roughly the same the rocket's mass drops each second.

Time (s) +/- 0.5	Total Force on Rocket (N) +/- 100	Mass of Rocket (kg)	Acceleration (m/s^2) +/- 1
0.0	45000	10000	4.5
3.0	45000	8000	5.625
6.0	45000	6000	7.5
9.0	45000	4000	11.25
12.0	45000	2000	22.5

$a = \frac{45000}{m}$



a) What is the pattern in the acceleration vs mass graph.

Inverse

b) Write the equation that represents the graph.

$a = \frac{45000}{m}$

c) Now you may have notice a slight over-simplification in our data table, if the mass is dropping, so then is the force of gravity pulling it down. If the thrust of the rocket stays roughly constant but the force of gravity lessens, how would this change the acceleration? Circle one:

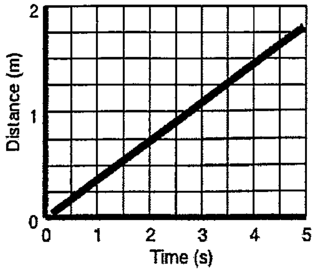
[✓ Make it bigger] No change Make it smaller

F_{net} would increase over time, so a would increase

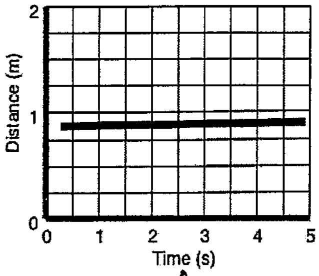
d) Write a high school level conclusion without a prediction for the acceleration vs mass graph.

Identify the Net Force for the following d vs t and v vs t graphs of a ball

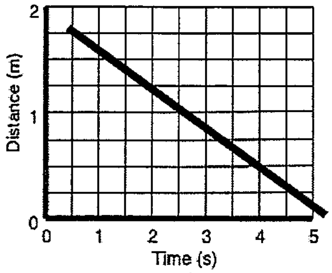
A -- Forces are Balanced ($F_{net} = 0$)
B -- Forces are Unbalanced ($F_{net} \neq 0$) and in the F_{net} is the direction of motion
C -- Forces are Unbalanced ($F_{net} \neq 0$) and in the F_{net} is the opposite direction of motion



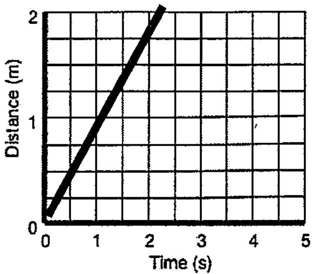
Answer : A



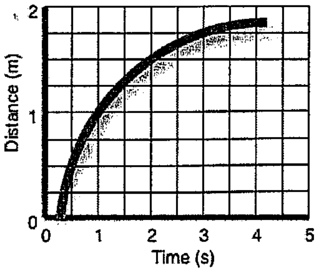
Answer : A



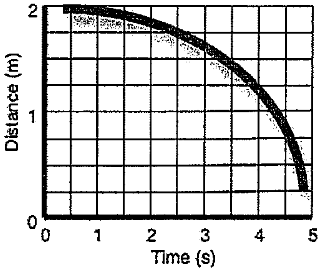
Answer : A



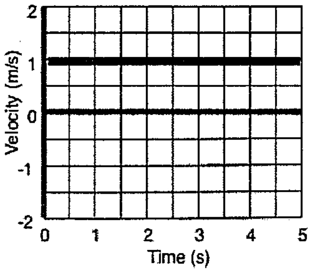
Answer : A



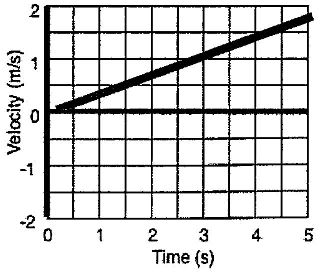
Answer : C



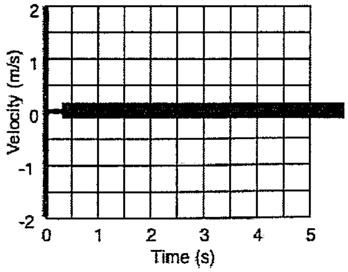
Answer : B



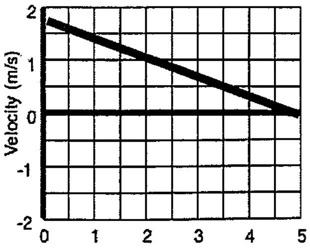
Answer : A



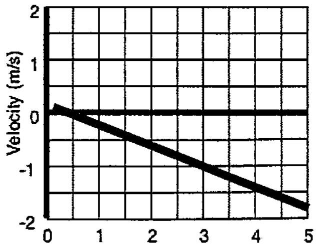
Answer : B



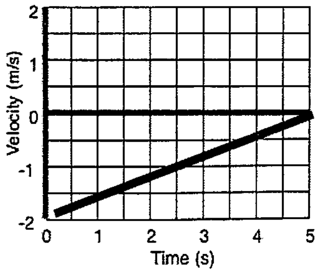
Answer : A



Answer : C



Answer : B



Answer : C

*****Ranking Task: order the graphs above from largest force to smallest force**