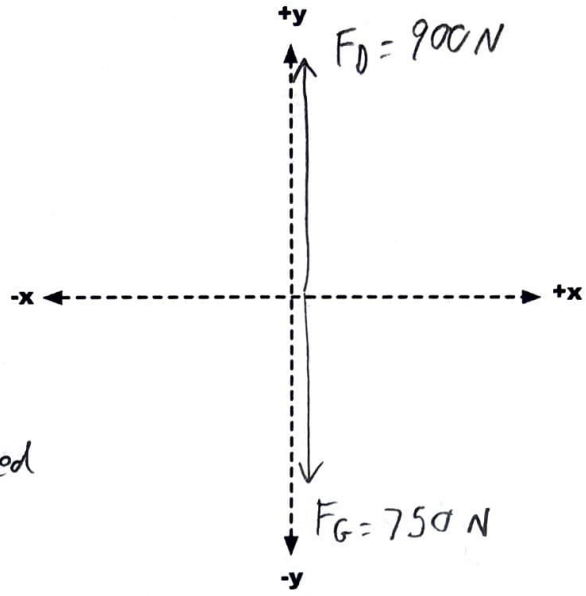
Final Exam: Review (Day 2)

The skydiver (mass 75 kg) experiences 900 N of Drag. The skydiver is initially falling with a speed of 20 m/s.
a) Put the forces on the diagram & find the net force.
b) Calculate the acceleration.
c) Fill in the table below.

mass = 75 kg means weight = 750N



$F_{Net} = 150N \uparrow$

since skydiver is falling down ↓

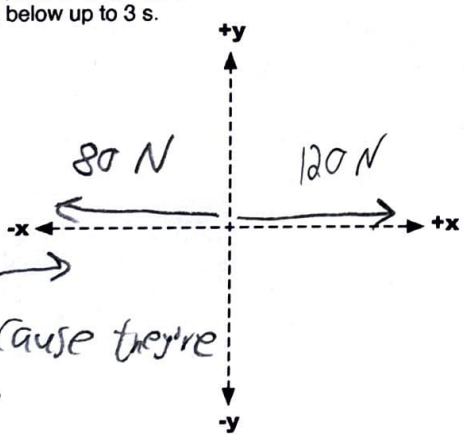
speed is down & they're losing speed

cause F_{Net} is ↑

$\frac{F_{Net}}{mass} = acceleration \Longrightarrow \frac{150N}{75kg} = 2\ m/s/s$

Speed at t = 0	Speed at t = 1 s	Speed at t = 2 s	Speed at t = 3 s	Speed at t = 4 s
-20 m/s	-18 m/s	-16 m/s	-14 m/s	-12 m/s

Jane pushes Lou in the shopping cart (combined mass 80 kg) with a force of 120 N. There is 80 N of friction due to the squeeky old wheels of the shopping cart. They start with an initial speed of 4 m/s.
a) Put the forces on the diagram & find the net force.
b) Calculate the speed change factor.
c) Fill in the table below up to 3 s.

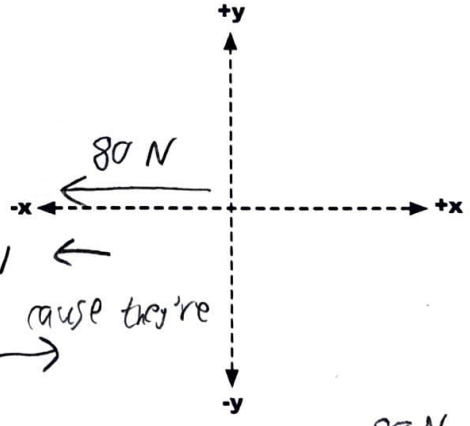


$F_{Net} = 40N \rightarrow$

Going speed cause they're moving →

$\frac{F_{Net}}{mass} = acceleration \Longrightarrow \frac{40N}{80kg} = 0.5\ m/s/s$

Then after t = 4 s, Jane stops pushing, and Jed continues with only the friction force in the x-direction.
a) Put the forces on the diagram & find the net force.
b) Calculate the speed change factor.
c) Fill in the rest of the table.



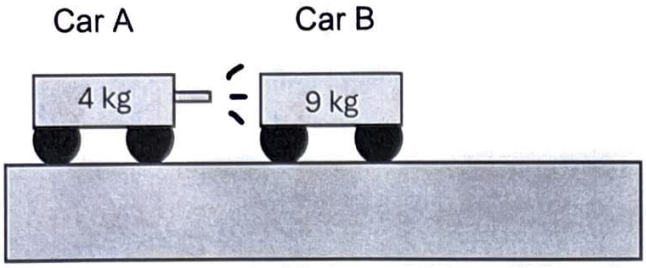
$F_{Net} = 80N \leftarrow$

slowing down cause they're moving →

$\frac{F_{Net}}{mass} = acceleration \Longrightarrow \frac{80N}{80kg} = 1\ m/s/s$

Speed at t = 0	Speed at t = 1 s	Speed at t = 2 s	Speed at t = 3 s	Speed at t = 4 s	Speed at t = 5 s	Speed at t = 6 s	Speed at t = 7 s
4 m/s	4.5 m/s	5 m/s	5.5 m/s	4.5 m/s	3.5 m/s	2.5 m/s	1.5 m/s

Final Exam: Review (Day 2)



Forces come in pairs when a Force is applied one way, there is an equal Force the other way

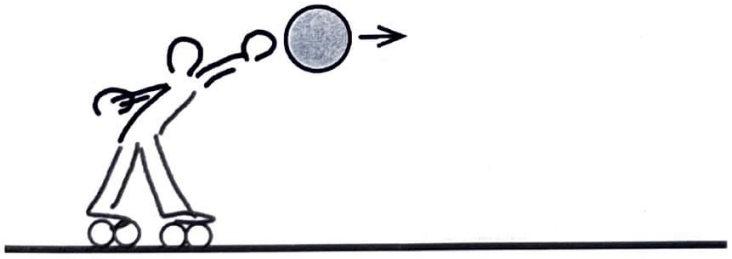
If Car A exerts a force of 36 Newton's to Car B how much will…

a. Car A accelerate and in which direction?

$\frac{36\,N}{4\,kg} = 9\,m/s/s \leftarrow$

b. Car B accelerate and in which direction?

$\frac{36\,N}{9\,kg} = 4\,m/s/s \rightarrow$



Same logic here!

The kid throws a 1.2kg ball with a force of 24 N to the right (assume no friction on the ball)

a. What is the acceleration of the ball?

$\frac{24\,N}{1.2\,kg} = 20\,m/s/s$

b. What is the acceleration of the kid who is wearing roller blades with minimal friction and has a mass of 48kg?

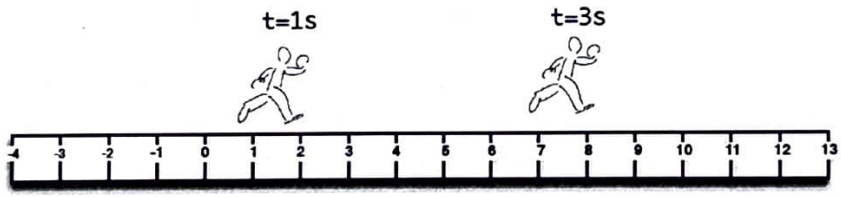
$\frac{24\,N}{48\,kg} = 0.5\,m/s/s$

Final Exam: Review (Day 2)

For the statements below, determine if the word in the blank space is "positive" or "negative"

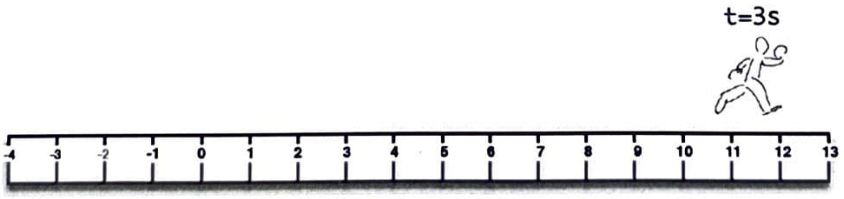
- When something is moving to the right, it's velocity is Positive
- When something is moving to the left, it's velocity is negative
- When something is moving to the right, and speeding up, its velocity is positive and its acceleration is positive
- When something is moving to the right, and slowing down, its velocity is positive and its acceleration is negative
- When something is moving to the left, and speeding up its velocity is negative and its acceleration is negative
- When something is moving to the left, and slowing down, its velocity is negative and its acceleration is positive

Fill in the unknowns in the table below!



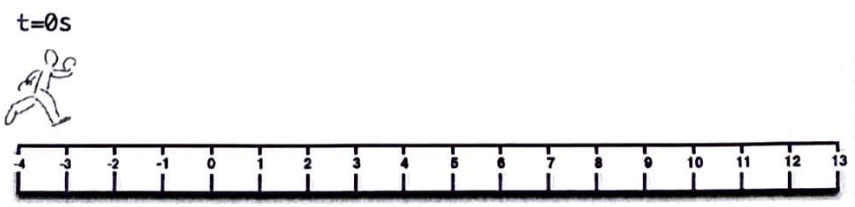
They are running at a constant velocity.

t (s)	x (m)	v (m/s)
0	-1	3
1	2	3
2	5	3
3	8	



Their acceleration is +3 m/s/s.

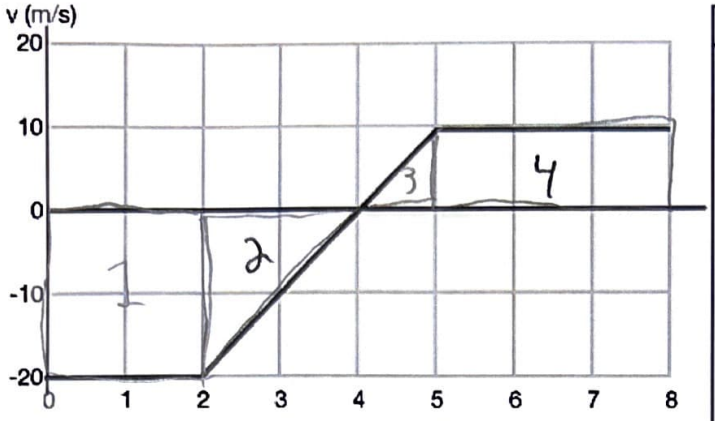
t (s)	x (m)	v (m/s)
0	0	1
1	1	4
2	5	7
3	12	



Their acceleration is -2 m/s/s.

t (s)	x (m)	v (m/s)
0	-3	7
1	4	5
2	9	3
3	12	

Final Exam: Review (Day 2)



-25 meters so
25 meters to the left

total change in position calculation

① 20 × 2
Area = (20)(2) = 40
-40 m

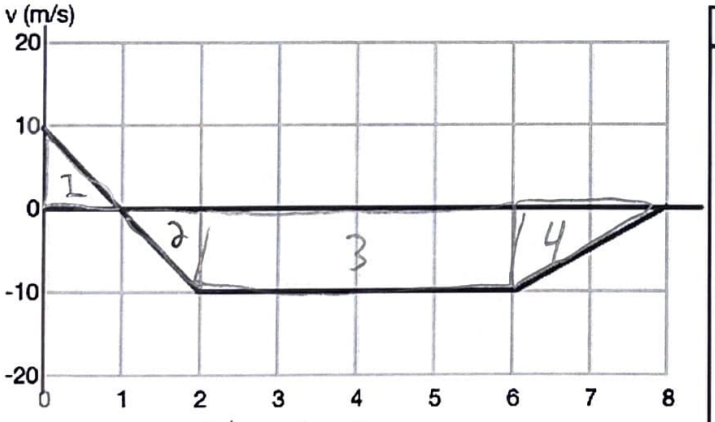
② 2 × 20
Area = $\frac{1}{2}$(20)(2) = 20 -20m

③ 10 × 1
Area = $\frac{1}{2}$(1)(10) = 5
+5 m

④ 10 × 3
Area = (3)(10) = 30
+30m

-40-20+5+30 = -25m

from when to when	description (words)	acceleration calculation
0 - 2	constant speed of 20 m/s moving left	0
2 - 4	slow down to rest moving left	$\frac{rise}{run} = \frac{20}{2} = +10$ m/s/s
4 - 5	speed up to 10 m/s moving right	$\frac{rise}{run} = \frac{10}{1} = +10$ m/s/s
5 - 8	constant speed of 10 m/s moving right	0



-50 meters so
50 meters to the left

total change in position calculation

① 10 × 1
Area = $\frac{1}{2}$(10)(1)
= +5 m

② 1 × 10
Area = $\frac{1}{2}$(10)(1)
= -5m

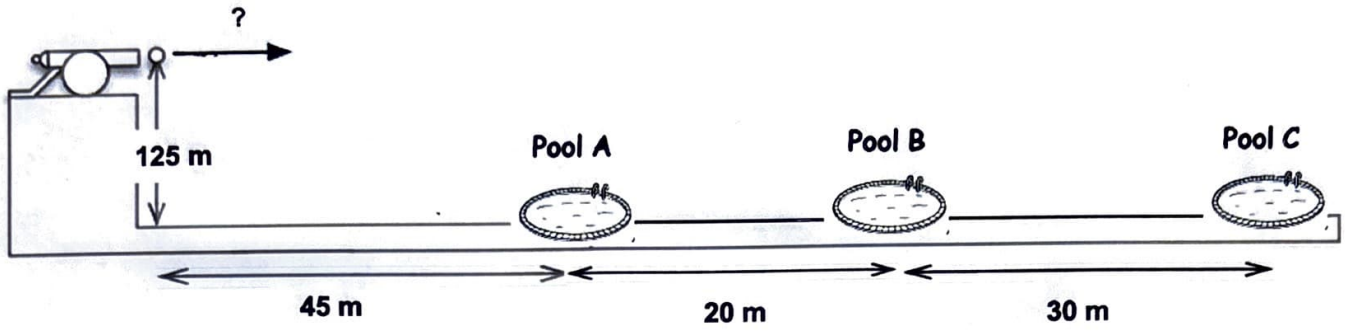
③ 10 × 4
Area = (10)(4) = 40 = -40m

④ 2 × 10
Area = $\frac{1}{2}$(10)(2) = 10 = -10m

5 - 5 - 40 - 10 = -50m

from when to when	description (words)	acceleration calculation
0 - 1	slowing down to rest moving right	$\frac{rise}{run} = \frac{-10}{1} = -10$ m/s/s
1 - 2	speeding up to 10 m/s moving left	$\frac{rise}{run} = \frac{-10}{1} = -10$ m/s/s
2 - 6	constant speed of 10 m/s to the left	0
6 - 8	slowing down to rest moving left	$\frac{rise}{run} = \frac{10}{2} = +5$ m/s/s

Final Exam: Review (Day 2)



How fast does the cannonball need to be launched to land in…

- Pool A: 9 m/s
- Pool B: 13 m/s
- Pool C: 19 m/s

"x" direction kinematics

$a_x = 0$ m/s/s

$t = 5$ sec

d = known for each pool

find "$v_{i,x}$"

use "$d = v_i t + \frac{1}{2} a t^2$" for all 3!

A: $d = 45$ m; $45 = v_i(5)$; $v_i = 9$ m/s

B: $d = 65$ m; $65 = v_i(5)$; $v_i = 13$ m/s

C: $d = 95$ m; $95 = v_i(5)$; $v_i = 19$ m/s

"y" direction kinematics

$v_{i,y} = 0$ m/s

$d_y = -125$ m

$a_y = -10$ m/s/s

} every time

solve for "t"

$d = v_i t + \frac{1}{2} a t^2$

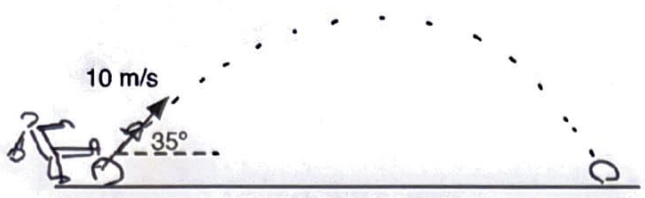
$-125 = 0 + \frac{1}{2}(-10) t^2$

$-125 = -5 t^2$

$25 = t^2$

$t = 5$ seconds

Final Exam: Review (Day 2)



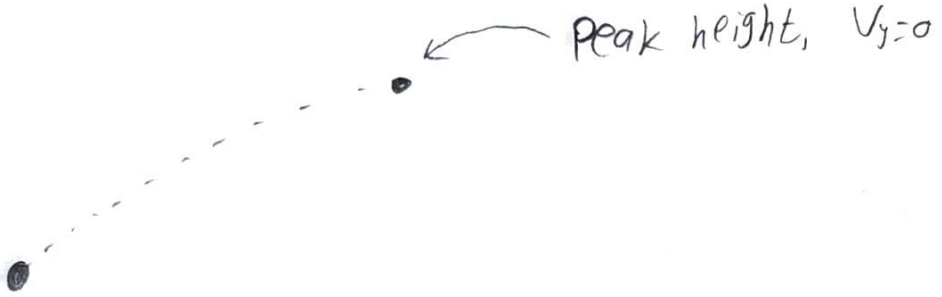
The soccer ball is kicked and lands at the same height.

a. Solve for Vx and Vy.
b. How long was the ball in flight?
c. What horizontal distance did the ball travel?
d. How high above the start height did the ball get?

a.) $V_x = (10\ m/s)\cos(35) = 8.2\ m/s$

$V_y = (10\ m/s)\sin(35) = 5.7\ m/s$

b.)



$t = ?$

$V_{i,y} = 5.7\ m/s$

$V_{f,y} = 0$

$a_y = -10\ m/s/s$

$V_f = V_i + at$

$0 = 5.7 + (-10)t$

$t = 0.57\ sec$

DOUBLE IT

$t = 1.14\ sec$

c.) $d_x = ?$

$V_{i,x} = 8.2\ m/s$

$a_x = 0$

$t = 1.14\ sec$

$d = V_i t + \frac{1}{2}at^2$

$d = (8.2)(1.14) + \frac{1}{2}(0)t^2$

$d = 9.3\ m$

d.) Looking for maximum "d_y"

$d_y = ?$ $V_{i,y} = 5.7\ m/s$ $V_{f,y} = 0$

$a_y = -10\ m/s/s$

$V_f^2 = V_i^2 + 2ad$

$0^2 = (5.7)^2 + 2(-10)d$

$d = 1.6\ m$