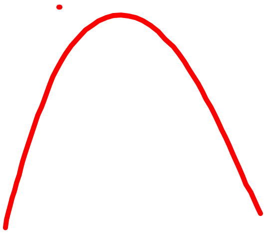
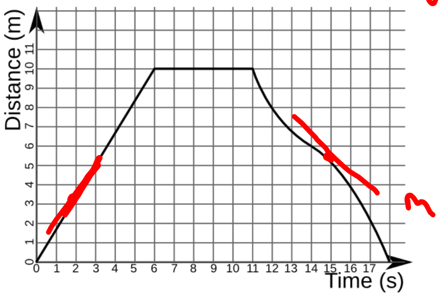
11/13/2013
notes: page 75.5

do now:

The following graph represents the distance travelled by Mr. Norman vs. time.
What would be the slope of the tangent line to the graph below at t = 3? $m = 5/3$

slope represents velocity



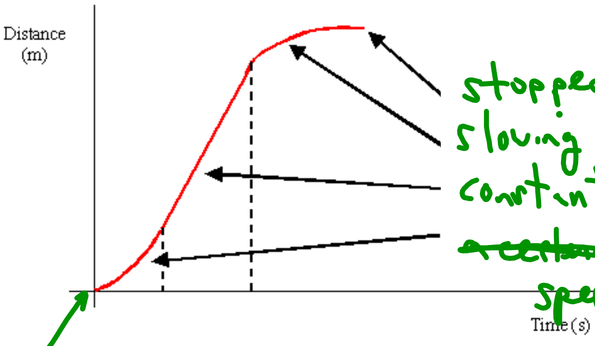


$5/3$ m/sec

$m = -1$

velocity = -1 m/sec

Things to note:
* this is motion in one ~~direction~~ dimension.
* slope of the tangent line on the distance graph represents velocity
* speed = abs value of velocity
* how can you tell where the velocity = 0?
→ when slope of tangent line = 0.



stopped

slowing down

constant velocity, steepest slope so fastest here.

~~accelerating~~ speeding up

starts from a stop

Preparing for your Related Rates Quiz (it's on Wednesday 11/20/2013)

Study suggestions:

1) complete several problems each day. Come ask for help as needed.

W, day 1: 4 8 12 16
R, day 2: 5 9 13 17 20 22 24
F, day 3: 6 10 14 18 21 23 25
M, day 4: 7 11 15 19

2) memorize formulas. Make flashcards!

3) In days 2-6, rework the exercises again after covering up your previous solutions.

4) watch youtube videos!

5) form study groups. Do a Calculus problem at lunch in the cafeteria. Or at Panera.

Straight Line Motion - Classwork

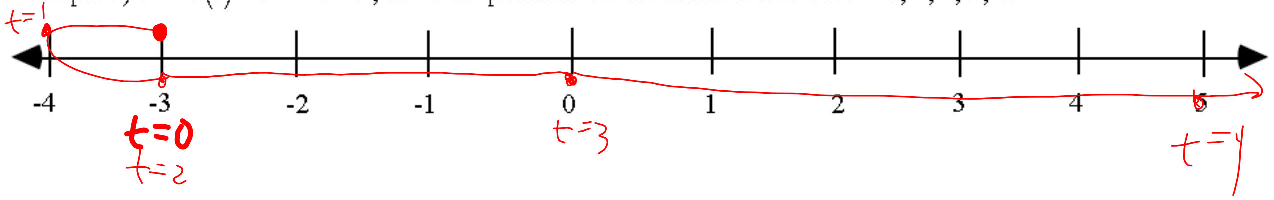
Consider an object moving along a straight line, either horizontally or vertically. There are many such objects, natural, and man-made. Write down several of them.

Horizontal cars, train, turtles, boat, John

Vertical rockets, kites, helicopters

As an object moves, its position is a function of time. For its position function, we will denote the variable $s(t)$. For instance, when $s(t) = t^2 - 2t - 3$, t in seconds, $s(t)$, we are being told what position on the horizontal or vertical number line the particle occupies at different values of t.

Example 1) For $s(t) = t^2 - 2t - 3$, show its position on the number line for t = 0, 1, 2, 3, 4.



Speed is not synonymous with velocity. Speed does not indicate direction. So we define the speed function: **speed** $= |v(t)|$. The speed of an object must either be positive or zero (meaning that the object is stopped).

The definition of acceleration is the change of velocity over time. We know this to be a derivative and can thus say that $a(t) = v'(t) = s''(t)$. So given the position function $s(t)$, we can now determine both the velocity and acceleration function. On your cars, you have two devices to change the velocity: brake, gas. Let us think as something accelerating the object to be some external force like wind or current. For convenience sake, let us define the acceleration function like this:

Motion	$a(t) > 0$	$a(t) < 0$	$a(t) = 0$
Horizontal Line	object accelerating to the right	object accelerating to the left	velocity not changing
Vertical Line	object accelerating upwards	object accelerating downwards	velocity not changing

Just because an object's acceleration is zero does not mean that the object is stopped. It means that the velocity is not changing. What device do you have on your cars that keeps the car's acceleration equal to zero? ____________

Also, just because you have a positive acceleration does not mean that you are moving to the right. For instance, suppose you were walking to the right $[v(t) > 0]$, when all of a sudden a large wind started to blow to the left $[a(t) < 0]$. What would that do to your velocity? slow you down

$2t - 6 = 0$
$t = 3$

Example 3) A particle is moving along a horizontal line with position function $s(t) = t^2 - 6t + 5$. Do an analysis of the particle's direction (right, left), acceleration, motion (speeding up, slowing down), & position.

Step 1: $v(t) =$ $2t - 6$ So $v(t) = 0$ at $t =$ 3

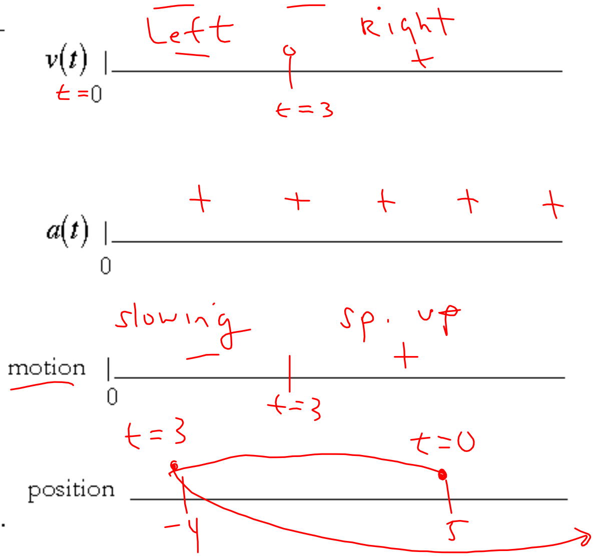
Step 2: Make a number line of $v(t)$ showing when the object is stopped and the sign and direction of the object at times to the left and right of that. Assume $t > 0$.

Step 3: $a(t) =$ 2 . Does $a(t) = 0$? never

Step 4: Make a number line of $a(t)$ showing when the object has a positive and negative acceleration. Scale it exactly like the $v(t)$ number line.

Step 5: Make a motion line directly below the last two putting all critical values, multiplying the signs and interpreting according to the chart above.

Step 6: Make a position graph to show where the object is at critical times and how it moves.



$s(0) = 5$
$s(3) = -4$