Position, Velocity, & Acceleration (Std 2h) **Name**_____

Given the equation for the position of a particle at time *t*, indicate

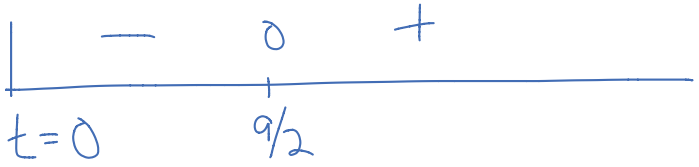
a) when the particle is moving to the left
b) when and where the particle changes directions
~~c) its maximum and minimum velocities~~

1) $x(t) = t^2 - 9t - 14 \quad t \geq 0$

$x'(t) = 2t - 9 = 0$

a) $0 < t < 4.5$ seconds

b) $t = 4.5$ seconds at $x(4.5) = -34.25$



2) $x(t) = t^3 - 9t^2 + 15t + 4 \quad t \geq 0$

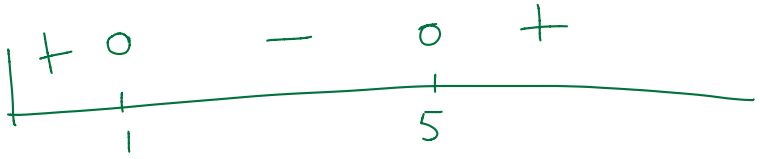
$x'(t) = 3t^2 - 18t + 15 = 0$

$(3t-3)(t-5) = 0$

$3(t-1)(t-5) = 0$

a) $1 < t < 5$

b) $t = 1, 5$ seconds at $x(1) = 11$ and $x(5) = -21$



3) $x(t) = 3t^4 - 22t^3 + 30t^2 + 48t + 1 \quad t \geq 0$

$x'(t) = v(t) = 12t^3 - 66t^2 + 60t + 48 = 0$

2	12	-66	60	48
		24	-84	-48
	12	-42	-24	0

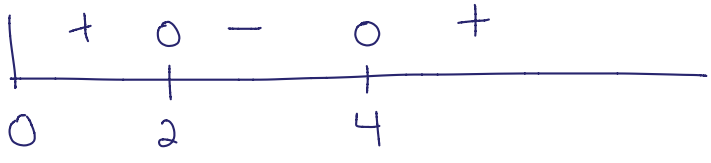
$(t-2)(12t^2 - 42t - 24) = 0$

$6(t-2)(2t^2 - 7t - 4) = 0$

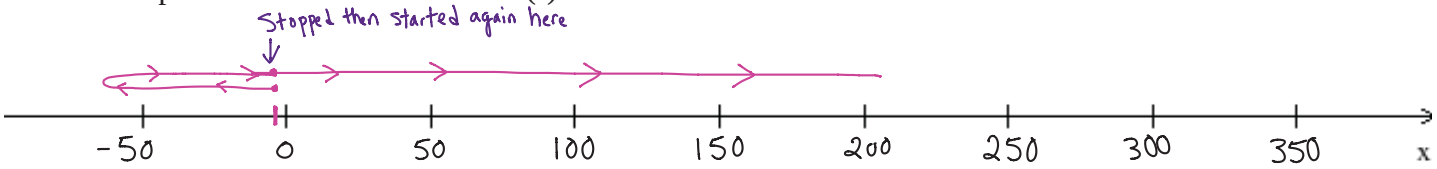
$6(t-2)(2t+1)(t-4) = 0$

a) $2 < t < 4$

b) $t = 2, 4$ at $x(2) = 89$ and $x(4) = 33$



4) Gabby and Blaire are sitting on the *x*-axis arguing over who is the better student. In a fit of anger, Gabby begins chasing Blaire back and forth on the *x*-axis. Ryan and Ana sit with a bowl of popcorn watching and observing the chase over a period of 8 seconds. With a little help from Ana, Ryan determines the equation for Blaire's position on the *x*-axis to be $x(t) = t^4 - 15t^3 + 75t^2 - 125t - 2 \quad 0 \le t \le 8$



a) Where on the *x*-axis were they originally sitting?

$x(0) = -2$

b) During what times are they running to the right?

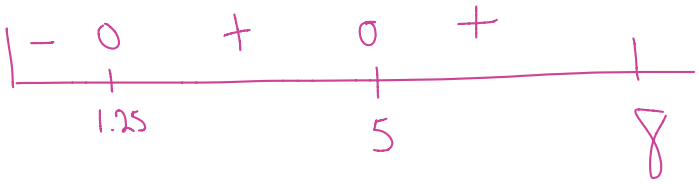
$v(t) = 4t^3 - 45t^2 + 150t - 125 = 0$

5| 4 -45 150 -125

4 | 20 -125 125

-25 25 0

$(t-5)(4t^2 - 25t + 25) = 0 = (t-5)(t-5)(4t-5)$



$1.25 < t < 5$

$5 < t < 8$

c) Does Blaire ever stop and then start again without changing directions? If so, when and where?

yes at $t = 5$ seconds and $x(5) = -2$

d) What are Blaire's maximum and minimum velocities?

$a(t) = 12t^2 - 90t + 150 = 0$

$= 6(2t-5)(t-5) = 0$

v is a max/min when $a(t) = 0$

$t = \frac{5}{2}, 5$ ← neither a max nor a min

$v\left(\frac{5}{2}\right) = 31.25$

e) On the number line above, draw the path of Blaire's run over 8 seconds indicating all points where she stops.