Motion WS 3

1. A particle moves along the x-axis according to the position function
   $x(t) = 4t^3 - 18t^2 + 15t - 1$, for $t \geq 0$.

   a. When is the particle at rest?
   b. When is the particle moving left?
   c. Find the particle's displacement from $t = 0$ to $t = 2$.
   d. Find the particle's distance traveled from $t = 0$ to $t = 2$.
   e. When is the particle's velocity increasing?
   f. When is the particle's speed increasing?
   g. What is the particle's acceleration when its velocity is first zero?
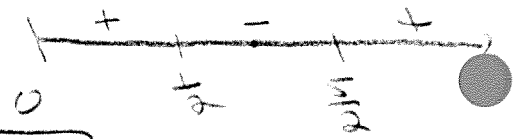
2. Given the velocity graph below:
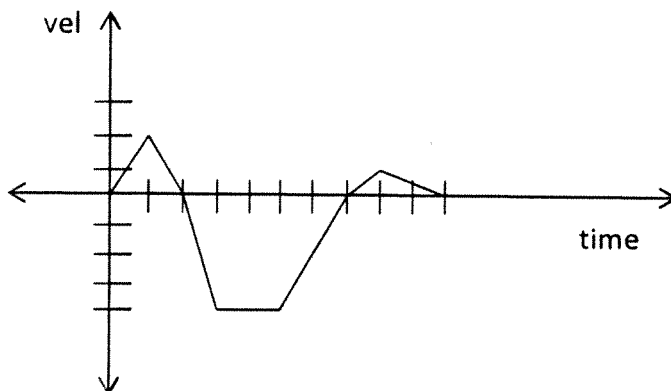
   a. At what times is the object at rest?
   b. When is the object moving left?
   c. When is the object's speed the greatest?
   d. When is the object's acceleration the greatest?
   e. When is the object's acceleration zero?
   f. When does the object change direction?
   g. Graph the acceleration function.

1. $x(t) = 4t^3 - 18t^2 + 15t - 1$ $\bigg/ = 0$

$v(t) = 12t^2 - 36t + 15$

$a(t) = 24t - 36$

b.

$\boxed{\left(\frac{1}{2}, \frac{5}{2}\right)}$

a. $12t^2 - 36t + 15 = 0$

$3(4t^2 - 12t + 5) = 0$

$(2t - 5)(2t - 1) = 0$

$\boxed{t = \frac{5}{2}, \ t = \frac{1}{2}}$

c. disp $= x(2) - x(0)$

$= -11 - (-1)$

$= \boxed{-10}$

d. start pos. $x(0) = -1$

turn pos $x\left(\frac{1}{2}\right) = 2.5$

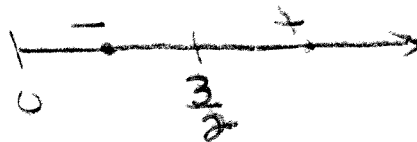stop pos $x(2) = -11$

right $= 3.5$

left $= 13.5$

$\boxed{\text{dist} = 17}$

e. $24t - 36 = 0$

$24t = 36$

$t = \frac{36}{24} = \frac{3}{2}$

$\boxed{\left(\frac{3}{2}, \infty\right)}$

accel # same

g. $v = 0$ first at $t = \frac{1}{2}$

$a\left(\frac{1}{2}\right) = 24\left(\frac{1}{2}\right) - 36 = \boxed{-24}$

f. vel + accel have the same sign

$\boxed{\left(\frac{1}{2}, \frac{3}{2}\right) \cup \left(\frac{5}{2}, \infty\right)}$

2. a. $t = 0, t = 2, t = 7, t = 10$

b. $(2, 7)$

c. $(3, 5)$

✗ d. $(0, 2) \cup (5, 7)$

e. $(3, 5)$

f. $t = 2, t = 7$

when is the obj Acceleration the greatest?

g.