MAT1505-03/04 19F Quiz 1 Print Name (Last, First) ________________________

Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use EQUAL SIGNS and arrows when appropriate. Always SIMPLIFY expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (but give decimal approximations for interpretation). Indicate where technology is used and what type (Maple, GC).

Consider the velocity function $v(t) = -9t^2 + 15t - 4$ on the interval $1 \le t \le 2$ whose graph is shown in the figure.

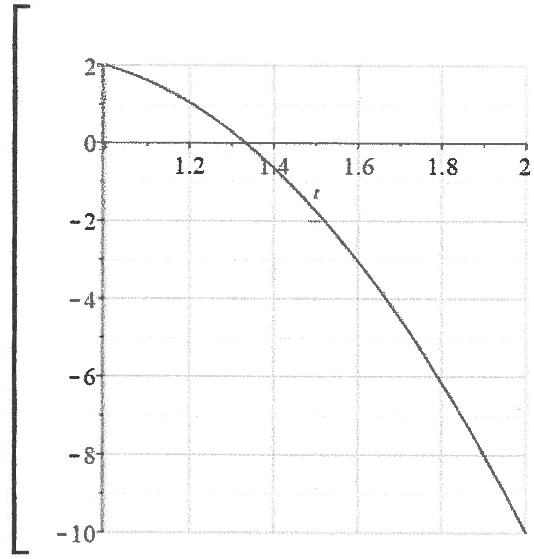
a) Find the time when the velocity is zero, both exactly and numerically to 6 decimal places in order to compare with the graph. Over what interval is the displacement increasing? Decreasing?
(Hint: Maple can easily solve the necessary equation if you wish to avoid the quadratic formula manipulation.)

b) Evaluate the exact displacement over this time interval, showing your work step by step, and give the numerical approximation to 6 decimal places.

c) Evaluate the exact distance traveled by setting up the integral and using technology to evaluate it, and its numerical approximation

d) How much distance was traveled while moving in the direction of the positive s axis?

[Recall $v(t) = s'(t)$ is the time rate of change of displacement along an axis.]



many students omitted this, but this is the eqn being solved!

for numerical approximation

a) $v(t) = -9t^2+15t-4 = 0 \xrightarrow[\text{Maple}]{\text{solve}} t = \frac{1}{3}, \frac{4}{3} \to \boxed{t = \frac{4}{3} \approx 1.333333}$ in given interval

[quadratic formula: $t = \frac{-15 \pm \sqrt{(15)^2 - 4(-9)(-4)}}{2(-9)} = \frac{-15 \pm \sqrt{225-144}}{-18} = \frac{-15 \pm 9}{-18} = \frac{5 \mp 3}{6}$
$= \frac{2}{6}, \frac{8}{6} = \frac{1}{3}, \frac{4}{3}$ even I get careless!]

$v(t) = s'(t) > 0$ means increasing displacement: $\boxed{1 \le t \le 4/3}$

decreasing: $\boxed{4/3 \le t \le 2}$

b) $\Delta s = \int_1^2 s'(t)\,dt = \int_1^2 v(t)\,dt = \int_1^2 -9t^2 + 15t - 4\,dt$

$= -9\frac{t^3}{3} + 15\frac{t^2}{2} - 4t \Big|_1^2 = -3 \cdot 2^3 + \frac{15}{2} \cdot 2^2 - 4(2) + 3(1)^3 - \frac{15}{2}(1)^2 + 4(1)$

$= -24 + 30 - 8 + 3 - \frac{15}{2} + 4 = 5 - \frac{15}{2} = \boxed{-\frac{5}{2}} \boxed{= -2.5}$

TV distraction!

c) distance $= \int_1^2 |v(t)|\,dt = \int_1^2 |-9t^2+15t-4|\,dt \overset{\text{Maple}}{=} \boxed{\frac{59}{18} \approx 3.277778}$

[$= \int_1^{4/3} +(-9t^2+15t-4)\,dt + \int_{4/3}^2 -(-9t^2+15t-4)\,dt = \dots$ see antiderivative above]
$\left(= \frac{7}{18} + \frac{26}{9} = \frac{59}{18}\right)$

d) $v(t) \ge 0$: $1 \le t \le 4/3$ so distance forwards $= \int_1^{4/3} (-9t^2+15t-4)\,dt$

$\overset{\text{Maple}}{=} \boxed{\frac{7}{18} \approx 0.388889}$

abs. value not needed here