26 Motion Part 2
#1-16

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Date Per

Circled #'s reference classwork

1) $s(t) = t^4 - 13t^3$

① $v(t) = 4t^3 - 29t^2$

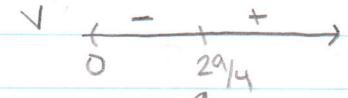
② $a(t) = 12t^2 - 78t$

③ $4t^3 - 29t^2 = 0$

$t^2(4t - 29) = 0$

$t = 0, 29/4$

changes direction at $t = 29/4$



④ moving left $(0, 29/4)$

⑤ moving right $(29/4, \infty)$

⑥ $12t^2 - 78t = 0$

$6t(2t - 13) = 0$

$t = 0, 13/2$

2) $s(t) = t^4 - 9t^3$

① $v(t) = 4t^3 - 27t^2$

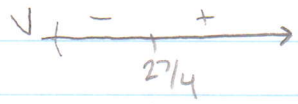
② $a(t) = 12t^2 - 54t$

③ $4t^3 - 27t^2 = 0$

$t^2(4t - 27) = 0$

$t = 0, 27/4$

changes direction at $t = 27/4$



④ moving left $0 < t < 27/4$

⑤ moving right $t > 27/4$

⑥ $12t^2 - 54t = 0$

$6t(2t - 9) = 0$

$t = 0, 9/2$

3. ① $s(2) = -2^3 + 30(2)^2 - 225(2) = -338$

② $v(t) = -3t^2 + 60t - 225$

$v(2) = -3(2)^2 + 60(2) - 225 = -117$

③ $|v(2)| = |-117| = 117$

④ $a(t) = -6t + 60$

$a(2) = -6(2) + 60 = 48$

4. ① $s(2) = (2)^3 - 18(2)^2 + 81(2) = 98$

② $v(t) = 3t^2 - 36t + 81$

$v(2) = 3(2)^2 - 36(2) + 81 = 21$

③ $|v(2)| = |21| = 21$

④ $a(t) = 6t - 36$

$a(2) = 6(2) - 36 = -24$

5) ① $\int_0^t \underbrace{-3u^2+60u-225}_{v(u)}\,du = \underbrace{-t^3+30t^2-225t}_{s(t)} - \underbrace{0}_{s(0)}$

6) ① $\int_0^t -3u^2+30u\,du = \underbrace{-t^3+15t^2}_{s(t)} - \underbrace{0}_{s(0)}$

7) ① $\int_0^t -3u^2+20u\,du = \underbrace{-t^3+10t^2}_{s(t)} - \underbrace{0}_{s(0)}$

8) ① $\int_0^t 3u^2-48u+144\,du = \underbrace{t^3-24t^2+144t}_{s(t)} - \underbrace{0}_{s(0)}$

9) ② $\int_0^t -6u+30\,du = \underbrace{-3t^2+30t}_{v(t)} - \underbrace{0}_{v(0)}$

① $\int_0^t -3u^2+30u\,du = \underbrace{-t^3+15t^2}_{s(t)} - \underbrace{0}_{s(0)}$

10) ② $\int_0^t 12u^2-54u\,du = \underbrace{4t^3-27t^2}_{v(t)} - \underbrace{0}_{v(0)}$

① $\int_0^t 4u^3-27u^2\,du = \underbrace{t^4-9t^3}_{s(t)} - \underbrace{0}_{s(0)}$

11) $\int_0^3 12t^2-60t\,dt = 4t^3-30t^2\Big]_0^3$

$= -162 - (0)$

$v(3) = -162$

$4(3)^3-30(3)^2 = -162$

$4(0)^3-30(0)^2 = 0$

12) $\int_0^6 12t^2-78t\,dt = 4t^3-39t^2\Big]_0^6$

$= -540 - (0)$

$v(6) = -540$

$4(6)^3-39(6)^2 = -540$

$4(0)^3-39(0)^2 = 0$

13) ① $\int_0^2 -4t^3+45t^2\,dt = -t^4+15t^3\Big]_0^2$ $\quad -(2)^4+15(2)^3 = 104$

$= 104-0$ $\quad -(0)^4+15(0)^3 = 0$

$S(2) = 104$

② $v(2) = -4(2)^3+45(2)^2 = 148$

14) ① $\int_0^6 -4t^3+42t^2\,dt = -t^4+14t^3\Big]_0^6$ $\quad -(6)^4+14(6)^3 = 1728$

$= 1728-0$ $\quad -(0)^4+14(0)^3 = 0$

$S(6) = 1728$

② $v(6) = -4(6)^3+42(6)^2 = 648$

15) ① $\int_5^{11} 3t^2-8t-60\,dt = t^3-4t^2-60t\Big]_5^{11}$ $\quad 11^3-4(11)^2-60(11) = 187$

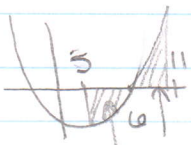
$= 187-(-275)$ $\quad 5^3-4(5)^2-60(5) = -275$

displacement $= 462$

② $3t^2-8t-60 = 0$

$(t-6)(3t+10)$

$t = 6, -10/3$



need area of pieces, make each positive

$\int_5^{11} |3t^2-8t-60|\,dt = -\int_5^6 3t^2-8t-60\,dt + \int_6^{11} 3t^2-8t-60\,dt$

$= -\left(t^3-4t^2-60t\right]_5^6 + \left(t^3-4t^2-60t\right]_6^{11}$

$-288 = 6^3-4(6)^2-60(6)$ $\quad = -(-288-(-275)) + (187-(-288))$

$= -(-13) + (475)$

distance $= 488$

11a) ① $\int_2^7 3t^2-48t+144\ dt = t^3-24t^2+144t\Big]_2^7$ $(7)^3-24(7)^2+144(7)=175$

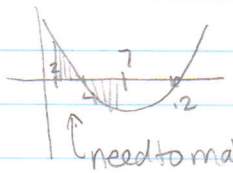
$= 175-200$ $(2)^3-24(2)^2+144(2)=200$

displacement $= -25$

② $3t^2-48t+144=0$

$3(t-12)(t-4)=0$

$t=4, 12$



↑ need to make area of each part positive

$$\int_2^7 \left|3t^2-48t+144\right| dt = \int_2^4 3t^2-48t+144\ dt - \int_4^7 3t^2-48t+144\ dt$$

$$= \left(t^3-24t^2+144t\right]_2^4 - \left(t^3-24t^2+144t\right]_4^7$$

$$= (256-200) - (175-256)$$

$4^3-24(4)^2+144(4)=256$ $= 56 - (-81)$

distance $= 137$