James Day

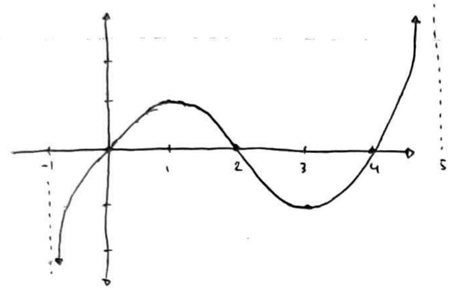
AP Calc AB: 2.1B HW

12. a. Runner A ran the race at a constant pace, but runner B began slow but eventually sped up.

b. Probably about $t = 8s$

c. Around $t = 10s$

24.



43. $\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$

$= \lim_{h \to 0} \frac{80(h+4) - 6(h+4)^2 - 224}{h}$

$= \lim_{h \to 0} \frac{80h + 320 - 6(h^2 + 8h + 16) - 224}{h}$

$= \lim_{h \to 0} \frac{80h + 320 - 6h^2 - 48h - 96 - 224}{h}$

$= \lim_{h \to 0} \frac{-6h^2 + 32h}{h}$

$= \lim_{h \to 0} -6h + 32$

$\boxed{= 32 \text{ m/s}}$

46. -50 °F/min

50. a. i. $\frac{9.4 - 53}{11 - 4} = -6.23$ copies/mL/day

ii. $\frac{9.4 - 18}{11 - 8} = -2.87$ copies/mL/day

iii. $\frac{5.2 - 9.4}{15 - 11} = -1.05$ copies/mL/day

iv. $\frac{3.6 - 9.4}{22 - 11} = -0.52$ copies/mL/day

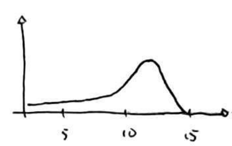
b. $\frac{5.2 - 18}{15 - 8} = -1.82$ copies/mL/day

This represents the rate of change in copies/mL on day 11.

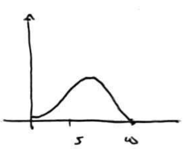
54. a. $f'(5)$ represents the rate of growth of bacteria after 5 hours. Units would be bacteria/hour.

b. If it were unlimited, you could expect exponential growth of bacteria. This would mean $f'(10) > f'(5)$.

If it were limited, then it would depend on the amount of nutrients. Growth could look like



or



56. a. $f'(8)$ represents the rate of change of quantity at \$8. The units would be lb/dollar

b. Positive. If it were negative you would be giving less coffee per lb per dollar, meaning it would cost less to buy more.

58. a. Rate of change of speed at temperature T. Units would be cm/s/C°

b. $\left.\begin{array}{l} S'(15) \approx 1 \text{ cm/s/C°} \\ S'(25) \approx -2 \text{ cm/s/C°} \end{array}\right\}$ Rate of change in speed at certain temperature

~~60. No. Because $x^2 \sin(\frac{1}{x})$ oscillates infinitely fast when $x \to 0$, the derivative would not be known as it too would be oscillating faster and faster.~~

60. Yes.

$-1 < \sin(\frac{1}{x}) < 1$

$-x^2 < x^2 \sin(\frac{1}{x}) < x^2$

$\lim_{x \to 0} -x^2 = 0 = \lim_{x \to 0} x^2$ ✓

Therefore, because $f(x) = \lim_{x \to 0} f(x)$, $f(x)$ is cont. and $\therefore$ differentiable.