MAT3-119 Take home Solution

1. $S' = kS$ $S(0) = 12g$ so $S(t) = 12 \cdot e^{kt}$

Find k: $15 = S(6) = 12 \cdot e^{k6}$ so $e^{k6} = 5/4$

Take ln of both sides: $6k = \ln 5/4$ $k \doteq .03919$

Solve $12e^{.03919 \cdot t} = 24$ $t \doteq \frac{\ln 2}{.03919} \doteq 18.64$ hrs.

2. $f(x) = x + \cos x$ $[0, 2\pi]$

$f'(x) = 1 - \sin x$

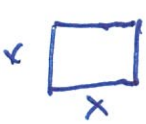
a. Stat. pts where $f'(x) = 0$ $\sin x = 1$ $x = \pi/2$

b. $f\uparrow$ where $f' > 0$. $1 - \sin x \geq 0$ for all x $[0, 2\pi]$

c. Since $f\uparrow$, min occurs at 0 $(=1)$ max occurs at π $(\pi - 1)$

d. $f'' = -\cos x$ $f'' < 0$ on $(0, \pi/2) \cup (\frac{3\pi}{2}, 2\pi)$

3. base



$V = x^2 h = 1000$ $h = \frac{1000}{x^2}$

Cost: $C(x) = 30 \cdot 4xh + 50x^2 + 20x^2$

$= 120x\left(\frac{1000}{x^2}\right) + 70x^2$

$c'(x) = 140x - \frac{120000}{x^2}$ $c'(x) = 0$ when $x^3 = \frac{120,000}{140}$

$x = \sqrt[3]{\frac{12,000}{14}} \doteq 9.5$

4. $F(x) = ex + 2e^x + -\cos(x+2) - 3\sin x + C$

5. $f'(x) = \ln 2 \cdot 2^x \cdot \cos x + 2^x(-\sin x)$

pt: $(\pi, -2^\pi)$ m: $-\ln 2 \cdot 2^\pi$

$-2^\pi = (-\ln 2 \cdot 2^\pi) \cdot \pi + b$ $b = -2^\pi + \ln 2 \cdot 2^\pi \cdot \pi$