Math 124 F Autumn 2012
Mid-Term Exam Number Two
November 20, 2012
Answers

There were two versions of the exam.
Version A: The specified interval in problem 1 is $\frac{1}{4} \leq x \leq \frac{3}{4}$.

1. The absolute minimum is $f(e^{-1/2}) = 0.831985...$ and the absolute maximum if $f(\frac{1}{4}) = 0.917004043204....$
2. The rate is $\frac{27}{4\pi}$ cm/sec.
3. (a) $\frac{d\theta}{dt} = \frac{600}{10081}$ radians per second (b) θ is changing fastest at $t = \frac{10}{3^{1/4}}$ seconds after launch.
4. (a) Many answers are possible. One uses the fact that $\ln e^4 = 4$ to yield an approximation of $4 + \frac{54-e^4}{e^4} = 3.989044499991....$ (b) The y-coordinate is approximately -0.01.
5. The two slopes are $-16/5$ and $16/3$.
6. (a) $x = \pm\frac{1}{\sqrt{2}}$ (b) $f(x)$ is increasing only on $-\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$. (c) $f(x)$ is decreasing on $x \leq -\frac{1}{\sqrt{2}}$ and $x \geq \frac{1}{\sqrt{2}}$. (d) $f(x)$ has a local minimum at $x = -\frac{1}{\sqrt{2}}$ and a local maximum at $x = \frac{1}{\sqrt{2}}$. (e) $f(x)$ has inflection points at $x = \pm\sqrt{\frac{3}{2}}$.

Version B: The specified interval in problem 1 is $0.6 \leq x \leq 0.9$.

1. The absolute minimum is $f(e^{-1/3}) = 0.884594...$ and the absolute maximum if $f(0.9) = 0.92606....$
2. The rate is $\frac{32}{9\pi}$ cm/sec.
3. (a) $\frac{100}{641}$ radians per second (b) θ is changing fastest at $t = (\frac{625}{3})^(1/4)$ seconds after launch.
4. (a) Many answers are possible. One using the fact that $lne^3 = 3$ to yield an approximation of $3 + \frac{20-e^3}{e^3} = 2.99574136....$ (b) The y-coordinate is approximately 0.01.
5. The two slopes are $-\frac{4}{3}$ and 4.
6. (a) $x = \pm\frac{1}{\sqrt{2}}$ (b) $f(x)$ is increasing only on $-\frac{1}{\sqrt{2}} \leq x \leq \frac{1}{\sqrt{2}}$. (c) $f(x)$ is decreasing on $x \leq -\frac{1}{\sqrt{2}}$ and $x \geq \frac{1}{\sqrt{2}}$. (d) $f(x)$ has a local minimum at $x = -\frac{1}{\sqrt{2}}$ and a local maximum at $x = \frac{1}{\sqrt{2}}$. (e) $f(x)$ has inflection points at $x = \pm\sqrt{\frac{3}{2}}$.