Math 1151, Quiz #9, Fall 2014          Name _____ KEY _____
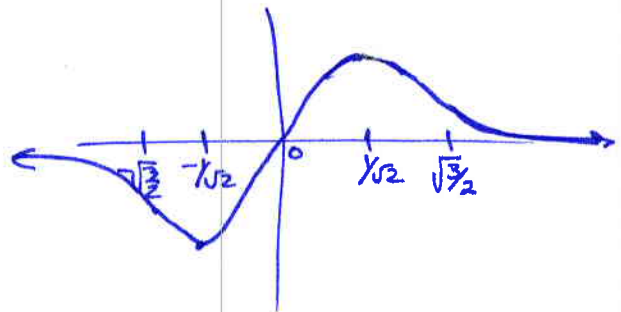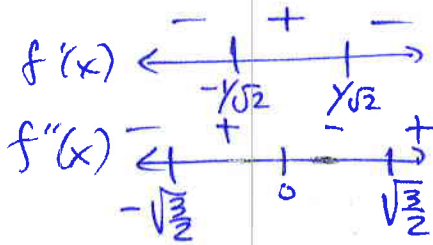
**Instructions:** Show all work. Answers without work may only receive partial credit. If you are asked for an explanation, explain as completely as possible. Use exact answers unless specifically asked to round.

1. Graph the function $f(x) = xe^{-x^2}$ on its domain. Use properties of derivatives to create the graph. (You may check your results in your calculator, but you will be graded on the work you show to support your graph.)

$$f'(x) = e^{-x^2} + xe^{-x^2}(-2x) = e^{-x^2}(1-2x^2) = 0 \qquad 1 = 2x^2$$
$$x = \pm \frac{1}{\sqrt{2}}$$
$$f''(x) = e^{-x^2}(-2x)(1-2x^2) + e^{-2x}(-4x) = e^{-x^2}(-6x + 4x^3) = 0$$
$$-2x(3 - 2x^2) \quad x = 0$$
$$x = \pm\sqrt{\tfrac{3}{2}}$$

$f'(x)$  — + —   $-\frac{1}{\sqrt{2}}$   $\frac{1}{\sqrt{2}}$

$f''(x)$  — + — +   $-\sqrt{\frac{3}{2}}$   $0$   $\sqrt{\frac{3}{2}}$



2. Graph the function $f(x) = \sqrt[3]{x}(x-2)^2$ on its domain. Use properties of derivatives to create the graph. (You may check your results in your calculator, but you will be graded on the work you show to support your graph.)
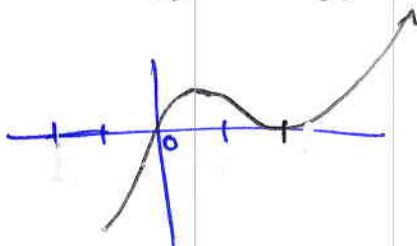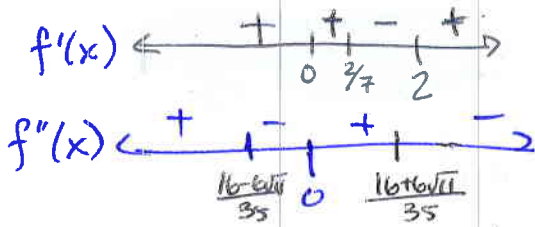
$$f'(x) = \tfrac{1}{3}x^{-2/3}(x-2)^2 + x^{1/3}(x-2)(2)$$
$$= \tfrac{1}{3}x^{-2/3}(x-2)\big[x-2+3(2)x\big] = \frac{1}{3\sqrt[3]{x^2}}(x-2)[7x-2] = 0$$
$$7x^2 - 16x + 4$$
$$\quad 6$$

$x = 2, \ x = \tfrac{2}{7}$   undef at $x = 0$

$$f''(x) = \tfrac{1}{3}\left(-\tfrac{2}{3}\right)x^{-5/3}(7x^2-16x+4) + \tfrac{1}{3}x^{-2/3}(14x-16)$$
$$= -\tfrac{2}{9}x^{-5/3}(7x^2-16x+4) + \tfrac{1}{3}x^{-2/3}(14x-16)$$
$$= -\tfrac{2}{9}x^{-5/3}[-35x^2 + 32x + 4]$$

$f'(x)$  + + — +   $0$  $\tfrac{2}{7}$  $2$

$f''(x)$  + — + —   $\frac{16-6\sqrt{11}}{35}$  $0$  $\frac{16+6\sqrt{11}}{35}$

$$X = 0 \qquad X = \frac{16 \pm 6\sqrt{11}}{35} \approx -.111, \ 1.0257$$