NAME: _____     Student ID #: _____

QUIZ SECTION:_____

# Math 124
# Midterm I
October 25, 2011

|  |  |  |
|---|---|---|
| Problem 1 | 12 |  |
| Problem 2 | 6 |  |
| Problem 3 | 4 |  |
| Problem 4 | 15 |  |
| Problem 5 | 7 |  |
| Problem 6 | 6 |  |
| **Total:** | **50** |  |

- Besides this cover page, your exam should contain 6 problems on 5 additional pages. Check that you have a complete exam!

- Unless otherwise instructed, **show all your work,** and use the methods learned in this class. Answers with no supporting work, or obtained by guess-and-check, will result in little or no credit, even if correct.

- Indicate your **final answer** by placing a box around it.

- Give your answers in exact form (ex: 1/3, not 0.33)

- If you need more room, use the backs of pages, but indicate to the grader that you have done so.

- Raise your hand if you have any questions.

**GOOD LUCK!**

1 (12 pts)   Determine the values of the following limits, or state that the limit does not exist. If it is correct to say that the limit is $+\infty$ or $-\infty$, then you should say so. Show your work. There will be little credit for answers without justification, or obtained by entering values in a calculator.
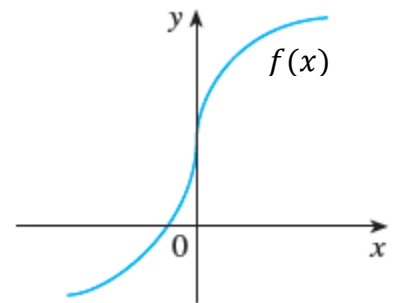
a) $\displaystyle\lim_{x\to\infty}\left(\frac{\sqrt{x^2-4x}}{3x-12}\right) =$

b) $\displaystyle\lim_{x\to\pi^-}(\ln(\sin(x))) =$

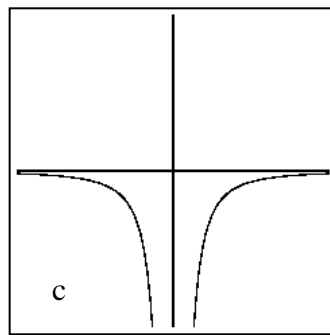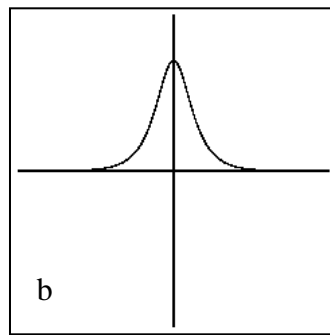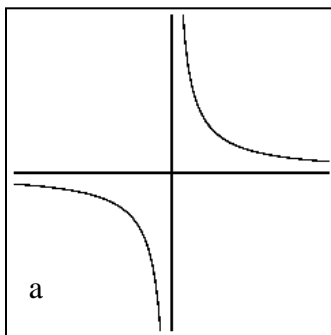c) $\displaystyle\lim_{t\to 3}\left(\frac{t-\sqrt{t+6}}{t-3}\right) =$

**2** (6 pts)  Compute the slope of the tangent line to $y = \dfrac{1}{\sqrt[3]{x}} + \dfrac{2x+7}{x}$ at the point (1, 10)

**3** (4 pts)  The graph on the right is the graph of a function $f$.



Which one of the following 4 graphs could be the graph of its derivative?
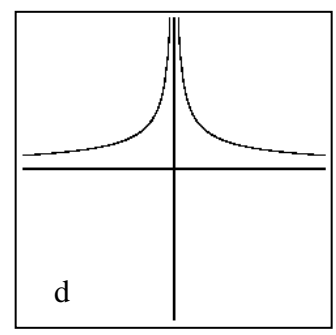


Graph of $f'$ is :_____ (no need to justify)

4 (15 pts) Consider the function:

$$f(x) = \begin{cases} 2x + 3 & \text{if } x \le 0 \\ \dfrac{4}{x + 1} & \text{if } 0 < x \le 1 \\ 2\sqrt{x} & \text{if } 1 < x \end{cases}$$

a) (4 pts) Compute the following four limits of this function:

$$\lim_{x \to 0^-} f(x) = \qquad\qquad\qquad \lim_{x \to 1^-} f(x) =$$

$$\lim_{x \to 0^+} f(x) = \qquad\qquad\qquad \lim_{x \to 1^+} f(x) =$$

b) (3 pts) List all the points where this function $f$ is **discontinuous**. For each point of discontinuity, specify the type: removable, jump or infinite.

c) (5 pts) Compute the derivative of $f$. Write it in bracket notation as above, with correct domain for each part.

d) (3 pts) List all real numbers where $f$ is **not differentiable** and justify why (discontinuity, corner, or vertical tangent)

5 (7 pts) An object moves in the xy-plane. Its coordinates at time $t$ seconds are given by the parametric equations:

$$x(t) = t \cos(t)$$
$$y(t) = t \sin(t)$$

Both coordinates are measured in inches, and the time is measured in seconds.

a) Compute the horizontal velocity of this object at time 0 seconds.

(Recall that the horizontal velocity is the instant rate of change of the x-coordinate)

Include correct units in your answer.

b) Write a formula in terms of $t$ for the distance $d(t)$ between the origin (0,0) and the position of this object at $t$ seconds. Simplify your formula.

$\boxed{6}$ (6 points) Determine the equation of the tangent line to the graph of $y = x^2 - x$, which passes through the point $(0, -1)$ and whose point of tangency P is in the second quadrant. See the picture below.

$$y = x^2 - x$$

P

(0, -1)