# Midterm #1

**MATH 125 — Calculus 1**
**Tuesday, Feb 5**

***Please print your name:***

Besides the allowed calculator, no notes or tools of any kind are permitted. There are 25 points in total.

**Good luck!**

**Problem 1. (6 points)** Determine the following limits (or state that they don't exist). [No need to show work here.]

(a) $\lim_{x\to 0} \frac{\sin(3x)}{7x} =$ ☐

(b) $\lim_{x\to \infty} \frac{\sin(3x)}{7x} =$ ☐

(c) $\lim_{x\to 1} \frac{\sin(3x)}{7x} =$ ☐

(d) $\lim_{x\to \infty} \frac{\sqrt{x}+7x^2-2}{3x^2+5} =$ ☐

(e) If $\lim_{x\to a} f(x) = 3$ and $\lim_{x\to a} g(x) = 5$, then $\lim_{x\to a} [f(x)^2 - 3g(x)] =$ ☐.

(f) If $\lim_{x\to 1} f(x) = 2$, $\lim_{x\to 1} g(x) = 3$ and $\lim_{x\to 2} g(x) = 4$, then $\lim_{x\to 1} g(f(x)) =$ ☐.

**Problem 2. (2 points)** Simplify! $e^{2\ln(x)-\ln(3y)} =$ ☐

**Problem 3. (2 points)** Let $f(x)$ be a complicated continuous function taking the following values:

| $x$ | $-3$ | $-2$ | $-1$ | $0$ | $1$ | $2$ | $3$ |
|---|---|---|---|---|---|---|---|
| $f(x)$ | $2$ | $3$ | $1$ | $-1$ | $-3$ | $4$ | $4$ |

How many solutions to the equation $f(x) = 3$ can we guarantee? ☐

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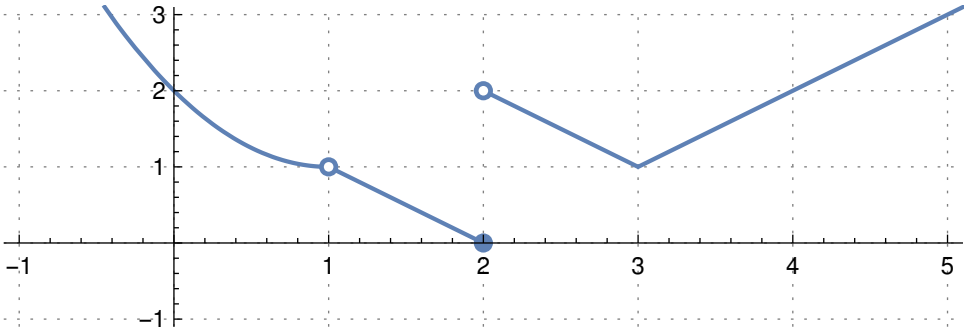
**Problem 4. (3 points)** Let $f(x)$ be the function graphed below. Fill in the blanks.




(a) $f(x)$ is continuous everywhere except at the following values of $x$: ____

(b) $f(x)$ has a removable discontinuity at the following values of $x$: ____

(c) $\lim_{x\to 2^+} f(x) =$ ____

**Problem 5. (4 points)** For what values of $a$ is $f(x) = \begin{cases} x^2 - a, & x < 1, \\ a\ln(x) + 2, & x \geqslant 1, \end{cases}$ continuous at every $x$? [Show work!]

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**Problem 6. (4 points)** Determine $\lim_{x\to\infty}\left(x-\sqrt{x^2+7x}\right)$. [Show work!]

**Problem 7. (4 points)** Determine $\lim_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$ for $f(x)=x^2+1$. [Show work!]

(extra scratch paper)