# Math 125 Exam #3 Key (Fall 2019)

**1** Domain is $(-\infty, \infty)$ and range is $(5, \infty)$.

**2** Equation becomes $e^{x^2+4x} = e^{12}$, and so $x^2 + 4x = 12$. This solves to give solution set $\{-6, 2\}$.

**3** Domain is

$$\left\{x : \frac{3x}{2x+11} > 0\right\} = (-\infty, -\tfrac{11}{2}) \cup (0, \infty).$$

**4** This becomes $e^{-0.2x} = -12$, which has no solution since the range of the exponential function is $(0, \infty)$..

**5** Find $h$ such that $400 = 760e^{-0.145h}$, which implies $-0.145h = \ln(400/760)$, and hence

$$h = -\frac{1}{0.145} \ln\left(\frac{10}{19}\right) \approx 4.43 \text{ km}.$$

**6** With laws of logarithms:

$$\log_2 \frac{(x-3)^3}{(2x-1)(x+1)}$$

**7a** We have

$$\log_6(x+4)(x+3) = 1 \quad\Rightarrow\quad (x+4)(x+3) = 6 \quad\Rightarrow\quad x = -6, -1.$$

The value $-6$ is an extraneous solution, and so the solution set is $\{-1\}$.

**7b** Taking logarithms of both sides:

$$x\ln(3/5) = (1-x)\ln 7 \quad\Rightarrow\quad x = \frac{\ln 7}{\ln(3/5) + \ln 7} = \frac{\ln 7}{\ln(21/5)}.$$

**8a** $A(11) = 100e^{-0.087(11)} \approx 38.4$ g.

**8b** Find $t$ for which $A(t) = \frac{1}{2}A_0$:

$$\frac{1}{2}A_0 = A_0e^{-0.087t} \quad\Rightarrow\quad e^{-0.087t} = \frac{1}{2} \quad\Rightarrow\quad -0.087t = \ln(1/2) \quad\Rightarrow\quad t \approx 7.97 \text{ days}.$$

Note that the value of $A_0$ is irrelevant.

**9** $140°32'49''$.

**10** $\sin\theta = -\frac{12}{13}$, $\cos\theta = \frac{5}{13}$, $\tan\theta = -\frac{12}{5}$, $\csc\theta = -\frac{13}{12}$, $\sec\theta = \frac{13}{5}$, $\cot\theta = -\frac{5}{12}$.

**11** $\cos\theta = -\frac{\sqrt{5}}{3}$, $\tan\theta = \frac{2}{\sqrt{5}}$, $\csc\theta = -\frac{3}{2}$, $\sec\theta = -\frac{3}{\sqrt{5}}$, $\cot\theta = \frac{\sqrt{5}}{2}$.

**12** Domain is $(-\infty, \infty)$, and range is $[-3, 5]$.

**13** Domain is

$$\left\{x : \frac{3\pi}{2}x \neq \frac{\pi}{2} + k\pi \text{ for any integer } k\right\} = \left\{x : x \neq \frac{2k+1}{3} \text{ for any integer } k\right\},$$

range is $(-\infty, -3] \cup [3, \infty)$.

**14** $y = 4\cos(12x)$.