

Practice Problems for MAT 123 Fall 2015 Midterm 1

1) Find the value of each of the following:

(a)  $\sin\left(\frac{5\pi}{6}\right)$

(b)  $\tan\left(\frac{7\pi}{4}\right)$

(c)  $\cos\left(-\frac{2\pi}{3}\right)$

(d)  $\sin\left(\frac{11\pi}{4}\right)$

(e)  $\tan\left(-\frac{8\pi}{3}\right)$

(f)  $\cos\left(\frac{15\pi}{2}\right)$

2) (a) If  $\sin x = \frac{4}{7}$  and  $\frac{\pi}{2} < x < \pi$ , find  $\cos x$

(b) If  $\cos A = -\frac{5}{6}$  and  $\pi < A < \frac{3\pi}{2}$ , find  $\tan A$

(c) If  $\tan y = \frac{-3}{8}$  and  $\frac{3\pi}{2} < y < 2\pi$ , find  $\cos y$ .

3) (a) Find all angles  $x$ , with  $0 < x < \pi$ , where  $\sin x = \frac{\sqrt{2}}{2}$

(b) Find all angles  $x$ , with  $0 < x < \pi$ , where  $\sin 2x = \frac{\sqrt{2}}{2}$

(c) Find all angles  $x$ , with  $0 < x < \pi$ , where  $\sin 3x = \frac{\sqrt{2}}{2}$

4) (a) What is the largest domain on which the function  $f(x) = \sqrt{x+7}$  is defined?

(b) What is the largest domain on which the function  $f(x) = \frac{\sqrt{x+7}}{x+2}$  is defined?

(c) What is the largest domain on which the function  $f(x) = \frac{\sqrt[3]{x+7}}{x+2}$  is defined?

- 5) (a) If  $f(x) = \frac{6x-5}{7}$  find  $f^{-1}(x)$ , if it exists.
- (b) If  $f(x) = \frac{\sqrt[3]{6x-5}}{7}$  find  $f^{-1}(x)$ , if it exists.
- (c) If  $f(x) = \frac{6x-5}{7x+1}$  find  $f^{-1}(x)$ , if it exists.
- (d) If  $f(x) = \frac{2-6x}{3+4x}$  find  $f^{-1}(x)$ , if it exists.
- 6) (a) If  $f(x) = \frac{1}{x-3}$  and  $g(x) = x^2 + 9$ , find:  
 (i)  $f(g(2))$ ; (ii)  $g(f(2))$ ; (iii)  $f(g(x))$
- (b) If  $f(x) = 4x + \pi$  and  $g(x) = \sin x$ , find:  
 (i)  $f\left(g\left(\frac{\pi}{6}\right)\right)$ ; (ii)  $g(f(0))$ ; (iii)  $f(g(x))$
- 7) Sketch a graph of the following:
- (a)  $y = 2\sin\left(x - \frac{\pi}{6}\right) + 3$
- (b)  $y = \frac{1}{2}\sin\left(x + \frac{\pi}{3}\right) + 1$
- (c)  $y = 4\cos\left(x - \frac{\pi}{4}\right) - 1$
- (d)  $y = 4\sin(3x - \pi) + 2$
- 8) (a) If  $f(x) = \begin{cases} 5x+2; & x < 2 \\ 3x+7; & x \geq 2 \end{cases}$ , for what values of  $x$  is  $f(x) = 1$ ?
- (b) If  $f(x) = \begin{cases} x^3 - 1; & x < 0 \\ x^3 + 1; & x \geq 0 \end{cases}$ , for what values of  $x$  is  $f(x) = 0$ ?
- (c) If  $f(x) = \begin{cases} \sqrt[3]{x+1}; & x \leq -1 \\ x; & -1 < x < 1 \\ \sqrt{x+1}; & x \geq 1 \end{cases}$ , for what values of  $x$  is  $f(x) = 0$ ?

9) Rodrigo is driving from Lansing to Columbus. He travels at 50 *mph* for two hours, then at 30 *mph* until he is 160 *miles* from Lansing, when he stops for 1 hour to have dinner with Priya.

After leaving Priya's house, he drives at  $65 \text{ mph}$  until he arrives in Columbus, which is 250 miles from Lansing. Write a function,  $f(t)$ , that describes his distance from Lansing, where  $t$  is time (in hours) since leaving Lansing.

10) Electricity is sold to residential customers according to the following rate plan. For the first 250 kilowatt-hours ( $kwh$ ) that a customer uses, the cost is  $\$0.24/kwh$ . For the next 500  $kwh$  that a customer uses, the cost is  $\$0.26/kwh$ . After that, the cost is  $\$0.28/kwh$ . Write a function,  $C(h)$ , that describes the cost of electricity for a residential customer, where  $h$  is the number of kilowatt-hours that a customer uses. How much will a customer pay who uses 1100  $kwh$  of electricity in a month?