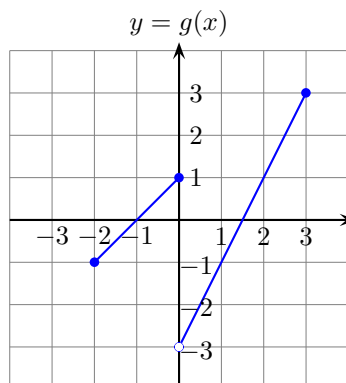
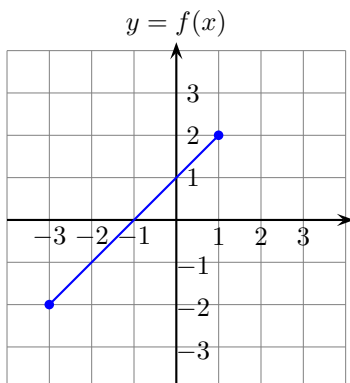


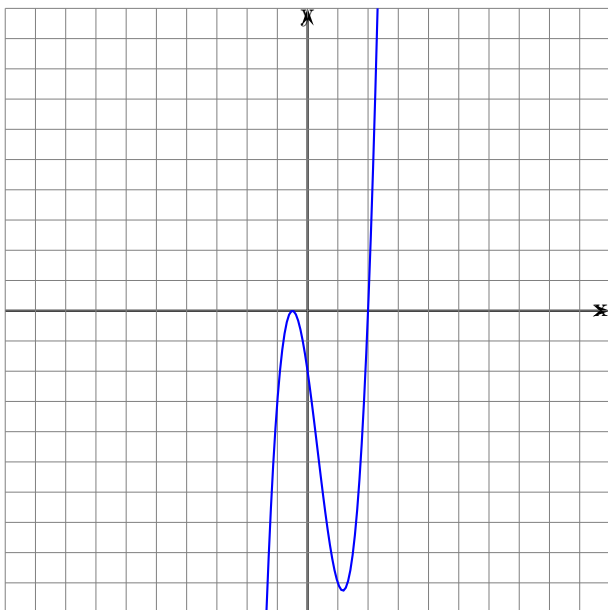
# Practice Exam

The answers

1. (10 points) Given the following functions  $f$  and  $g$  described by the graphs below:



- (a) Answer the the following questions using interval notation:
- Find the domain of  $f$ .  $[-3, 1]$
  - Find the range of  $f$ .  $[-2, 2]$
  - Find the domain of  $g$ .  $[-2, 3]$
  - Find the range of  $g$ .  $[-3, 3]$
  - Find an interval on which  $f$  is one-to-one.  $[-2, 0]$  or  $(0, 3]$
- (b) Evaluate the following if they exist:
- $g(0)$   $1$
  - $(f + g)(-2)$   $-2$
  - $\left(\frac{f}{g}\right)(-1)$  **Undefined**
  - $(f \circ g)(1)$   $0$
  - $(g \circ g)(1)$   $0$
2. (5 points) Let  $f(x) = x^2 - 2x + 5$  and  $g(x) = 3x - 2$ . Find  $f \circ g$ .  $(f \circ g)(x) = 9x^2 - 18x + 13$
3. (10 points) Let  $f(x) = 4x - 7$  and  $g(x) = \frac{x+7}{4}$ . Show that  $f$  and  $g$  are inverses.  
**Show that  $f(g(x)) = x$  and  $g(f(x)) = x$**
4. (5 points) Let  $f(x) = x^2 - 7x - 6$ .
- Find the vertex of the graph of  $y = f(x)$ .  $\left(\frac{7}{2}, -\frac{73}{4}\right)$
  - Find the  $x$ -intercepts of the graph of  $y = f(x)$ .  $\left(\frac{7+\sqrt{73}}{2}, 0\right), \left(\frac{7-\sqrt{73}}{2}, 0\right)$
  - Find the domain of  $f$ .  $(-\infty, \infty)$
  - Find the range of  $f$ .  $\left[-\frac{73}{4}, \infty\right)$
5. (10 points) Let  $f(x) = 4x^3 - 4x^2 - 7x - 2$ .
- List all possible rational roots of  $f$ , according to the Rational Zeros Theorem.  $\left\{\pm 1, \pm 2, \pm \frac{1}{2}, \pm \frac{1}{4}\right\}$
  - Factor  $f(x)$  completely.  $(x - 2)(2x + 1)^2$
  - Find the  $x$ -intercepts of the graph of  $y = f(x)$ .  $(2, 0), \left(-\frac{1}{2}, 0\right)$
  - Sketch a graph of  $y = f(x)$ .



6. (10 points) Solve the inequality:  $\frac{(x+2)(x-1)}{x^2(x-3)} \leq 0$ .  $(-\infty, 2] \cup [1, 3)$

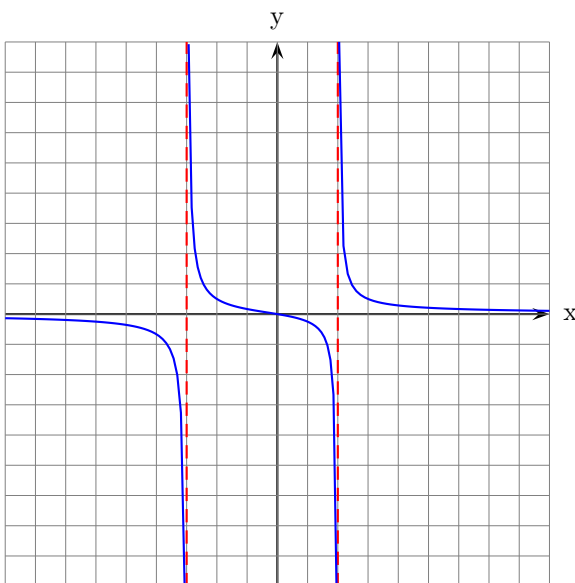
7. (10 points) Let  $g(x) = \frac{x}{(x+3)(x-2)}$ .

(a) Find the vertical asymptote(s) of the graph of  $y = g(x)$ .  $x = -3$  and  $x = 2$

(b) Find the horizontal asymptote of the graph of  $y = g(x)$ .  $y = 0$

(c) Find the  $x$ -intercept(s) of the graph of  $y = g(x)$ .  $(0, 0)$

(d) Sketch a graph of  $y = g(x)$ .



8. (15 points) Evaluate the following expressions. Give exact answers whenever possible.

(a)  $\log_5\left(\frac{1}{25}\right)$   $-2$

(b)  $\log_b(x^2y^3)$  given that  $\log_b x = 15$  and  $\log_b y = 4$   $42$

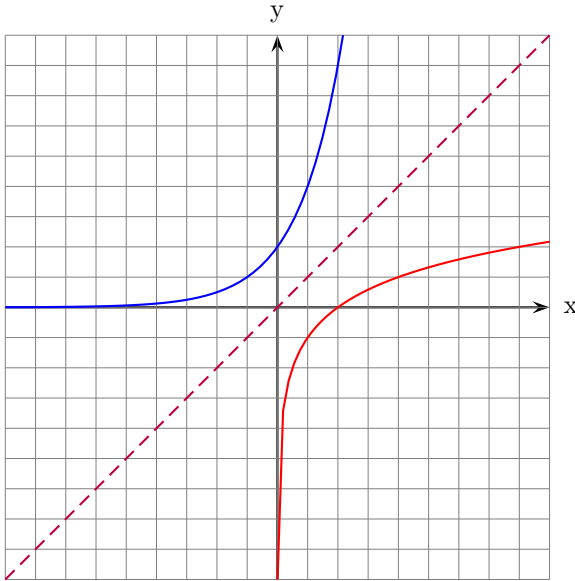
(c)  $\log_3(17)$  (rounded to the nearest hundredth).  $2.58$

(d)  $\sin^{-1}(\sin(\pi/6))$ .  $\frac{\pi}{6}$

- (e) Find  $\theta$  if  $\sin \theta = -0.5$  and  $\pi < \theta < \frac{3\pi}{2}$ .  $\frac{7\pi}{6}$
- (f) The remainder when dividing the polynomial  $x^{201} + 43$  by  $x + 1$ . 42
- (g) Find  $\sin(x + y)$  given that  $\sin x = 1/3$ ,  $\sin y = 3/5$ , and  $0 < x, y < \frac{\pi}{2}$ .  $\frac{4 + 6\sqrt{2}}{15}$

9. (10 points) Let  $g(x) = 2^{x+1}$ .

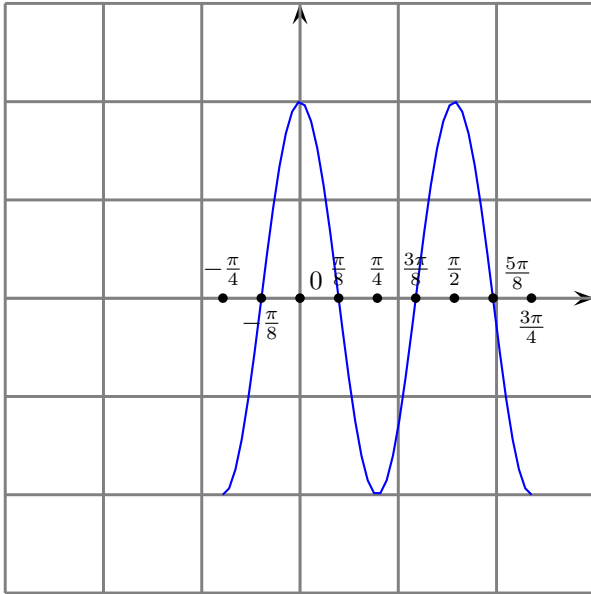
- (a) Find  $g^{-1}(x)$ .  $g^{-1}(x) = \log_2 x - 1$
- (b) Sketch a graph of  $y = g(x)$  and  $y = g^{-1}(x)$  on the same coordinate axes.



- (c) Discuss the relationship between the two graphs in part (b).  
The two graphs are symmetrically about the line  $y = x$ .

10. (10 points) Let  $f(x) = -2 \cos(4x - \pi)$ .

- (a) Find the period of the graph of  $y = f(x)$ .  $\frac{\pi}{2}$
- (b) Find the amplitude of the graph of  $y = f(x)$ . 2
- (c) Find the phase shift of the graph of  $y = f(x)$ .  $\frac{\pi}{4}$
- (d) Sketch two complete cycles of  $y = f(x)$ .



x

11. (10 points) Verify that for all  $x$   $\cos x + \tan x \sin x = \sec x$ .

Do the algebra.

12. (10 points) Solve the following equations:

(a)  $\log_3(x+6) + \log_3(x) = 3$ .  $x = 3$ ,  $x = -9$  is extraneous.

(b)  $4 \cos^2 x - 1 = 0$ , where  $x$  is in the interval  $[0, 2\pi)$ .  $x = \frac{\pi}{3}$ ,  $x = \frac{2\pi}{3}$ ,  $x = \frac{4\pi}{3}$ ,  $x = \frac{5\pi}{3}$

