

There are 33 problems on this exam. Carefully read and follow all directions. In order to receive credit show all necessary work. No credit will be given for an answer I cannot find or cannot read. All problems are worth 3 points unless indicated otherwise.

Use the following three functions to determine the specified information in problems 1-20.

$$f(x) = \sqrt{x+8} - 4 \quad g(x) = -(x-3)^3 \quad h(x) = \begin{cases} \sqrt{2-x} & \text{if } x < 2 \\ 3x+4 & \text{if } x \geq 2 \end{cases}$$

1. Domain of f

$$\begin{aligned} x+8 &\geq 0 \\ x &\geq -8 \end{aligned}$$

2. Range of f

$$[-4, \infty)$$

3. Domain of g

$$(-\infty, \infty)$$

4. Range of g

$$(-\infty, \infty)$$

$$\begin{aligned} 5. (f+g)(8) &= f(8) + g(8) \\ &= 0 + -125 \\ &= -125 \end{aligned}$$

$$\begin{aligned} 6. (f-g)(8) &= 0 - (-125) \\ &= 125 \end{aligned}$$

$$\begin{aligned} 7. (fg)(8) &= 0 \cdot -125 \\ &= 0 \end{aligned}$$

$$8. \left(\frac{f}{g}\right)(8) = \frac{0}{-125} = 0$$

$$9. (f \circ g)(1) = 0$$

$$1 \xrightarrow{g} 8 \xrightarrow{f} 0$$

$$10. (g \circ f)(1) = 64$$

$$1 \xrightarrow{f} -1 \xrightarrow{g} 64$$

$$11. (h \circ h)(-2) = 10$$

$$-2 \xrightarrow{h} 2 \xrightarrow{h} 10$$

$$12. (f \circ g \circ h)(-2) = -1$$

$$-2 \xrightarrow{h} 2 \xrightarrow{g} 1 \xrightarrow{f} -1$$

$$f(x) = \sqrt{x+8} - 4 \quad g(x) = -(x-3)^3 \quad h(x) = \begin{cases} \sqrt{2-x} & \text{if } x < 2 \\ 3x+4 & \text{if } x \geq 2 \end{cases}$$

$$13. f^{-1}(4) = 56$$

$$14. f^{-1}(x) = (x+4)^2 - 8$$

$$x \geq -4$$

$$15. g^{-1}(-8) = 5$$

$$16. (f \circ f^{-1})(6) = 6$$

In problems 17-18, use shifts and/or reflections to complete the given statement.

17. The graph of  $y = g(x)$  is the graph of  $y = x^3$  .....

*shifted 3 units right and then reflected over the x-axis*

18. The graph of  $y = f(x)$  is the graph of  $y = \sqrt{x}$  .....

*shifted 8 units left and 4 units down*

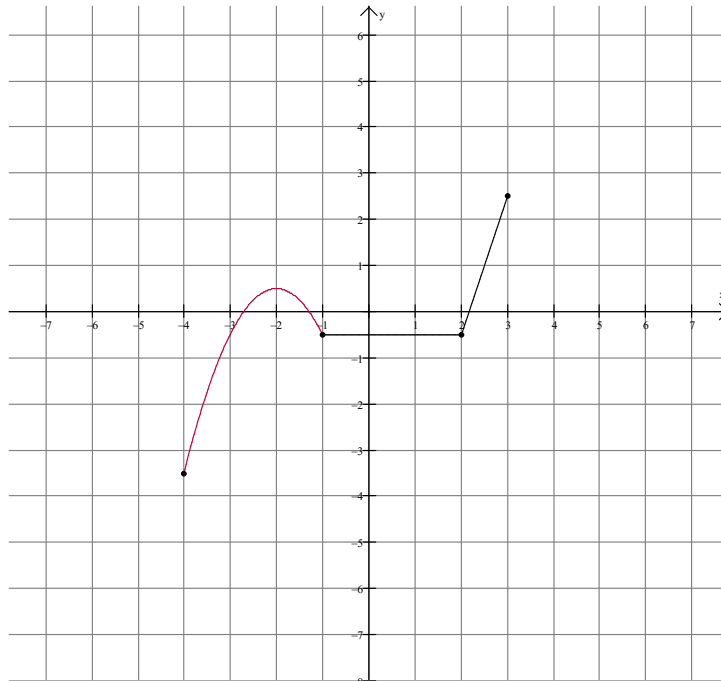
19. Determine the slope of the secant line containing the points  $(a, g(a))$  and  $(3, g(3))$ . Simplify your answer.

$$\frac{g(a) - g(3)}{a - 3} = \frac{-(a-3)^3 - 0}{a - 3} = -(a-3)^2$$

20. Determine the slope of the secant line containing the points  $(7, g(7))$  and  $(3, g(3))$ .

$$-(7-3)^2 = -16 \quad \text{or} \quad \frac{-64 - 0}{7 - 3} = \frac{-64}{4} = -16$$

Use the graph of the function  $F(x)$  shown below for problems 21-28.



21. Domain of  $F$

$$[-4, 3]$$

22. Range of  $F$

$$[-3.5, 2.5]$$

23. For what values of  $x$  is  $F$  decreasing?

$$(-2, -1)$$

24. For what values of  $x$  is  $F$  increasing?

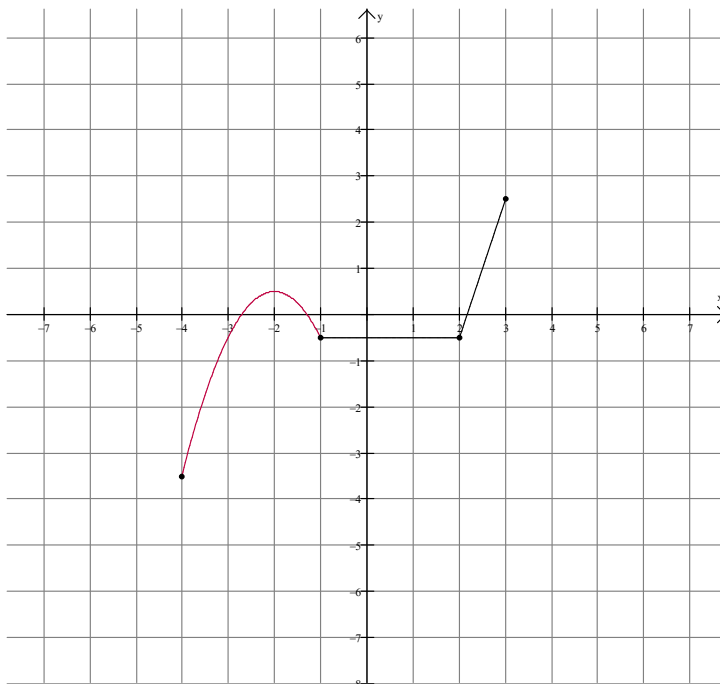
$$(-4, -2) \quad (2, 3)$$

25. For what values of  $x$  is  $F$  constant?

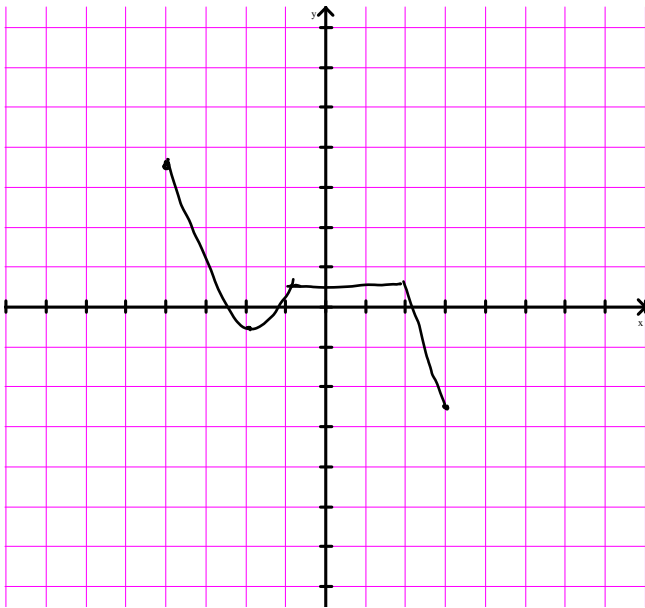
$$(-1, 2)$$

26. What type of extreme point is  $(-2, 0.5)$ ? Be specific.

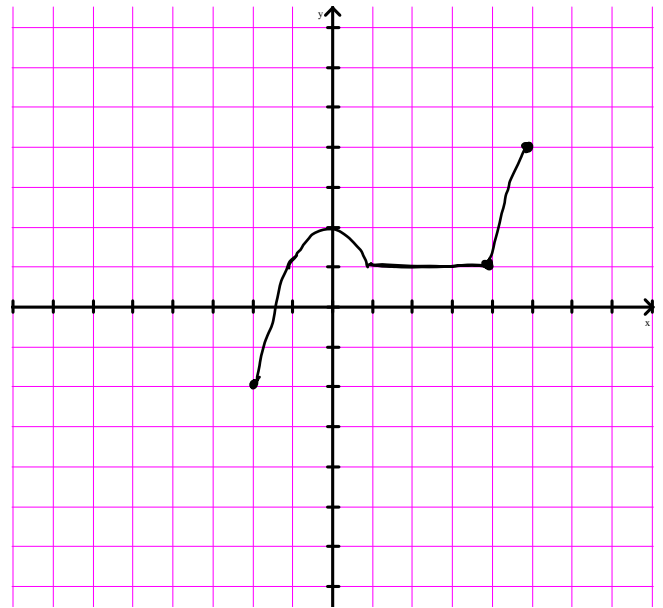
local max



27. Sketch the graph of  $y = -F(x)$ .



28. Sketch the graph of  $y = F(x - 2) + 1.5$ .



C

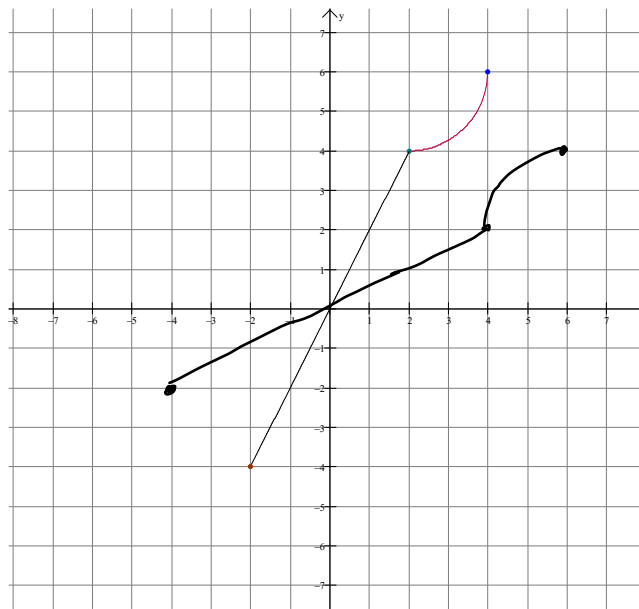
29. In which of the following window settings will the graph of  $y = 4G(x)$  look like the graph of  $y = G(x)$  in standard window?

- (A)  $x_{\min} = -40, x_{\max} = 40, x_{\text{sc1}} = 4, y_{\min} = -40, y_{\max} = 40, y_{\text{sc1}} = 4$
- (B)  $x_{\min} = -40, x_{\max} = 40, x_{\text{sc1}} = 4, y_{\min} = -10, y_{\max} = 10, y_{\text{sc1}} = 1$
- (C)  $x_{\min} = -10, x_{\max} = 10, x_{\text{sc1}} = 1, y_{\min} = -40, y_{\max} = 40, y_{\text{sc1}} = 4$
- (D)  $x_{\min} = -2.5, x_{\max} = 2.5, x_{\text{sc1}} = 0.25, y_{\min} = -10, y_{\max} = 10, y_{\text{sc1}} = 1$
- (E)  $x_{\min} = -10, x_{\max} = 10, x_{\text{sc1}} = 1, y_{\min} = -2.5, y_{\max} = 2.5, y_{\text{sc1}} = 0.25$

D 30. In which of the following window settings will the graph of  $y = G\left(\frac{1}{2}x\right)$  look like the graph of  $y = G(x)$  in standard window?

- (A)  $x_{\min} = -5, x_{\max} = 5, x_{\text{scl}} = 0.5, y_{\min} = -5, y_{\max} = 5, y_{\text{scl}} = 0.5$
- (B)  $x_{\min} = -5, x_{\max} = 5, x_{\text{scl}} = 0.5, y_{\min} = -10, y_{\max} = 10, y_{\text{scl}} = 1$
- (C)  $x_{\min} = -10, x_{\max} = 10, x_{\text{scl}} = 1, y_{\min} = -5, y_{\max} = 5, y_{\text{scl}} = 0.5$
- (D)  $x_{\min} = -20, x_{\max} = 20, x_{\text{scl}} = 2, y_{\min} = -10, y_{\max} = 10, y_{\text{scl}} = 1$
- (E)  $x_{\min} = -10, x_{\max} = 10, x_{\text{scl}} = 1, y_{\min} = -20, y_{\max} = 20, y_{\text{scl}} = 2$

31. Consider the graph of the function  $H(x)$  shown below.



What rule tells us that this function has an inverse function?

*horizontal line test*

32. On the grid in problem 31 sketch the graph of  $H^{-1}(x)$ .

PROBLEM 33 IS ON THE BACK OF THIS PAGE.

33. Sketch the graph of the following function. (4 points)

$$J(x) = \begin{cases} 3-x & \text{if } x < 2 \\ 2 & \text{if } 2 \leq x \leq 4 \\ 10-2x & \text{if } x > 4 \end{cases}$$

