

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.

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*

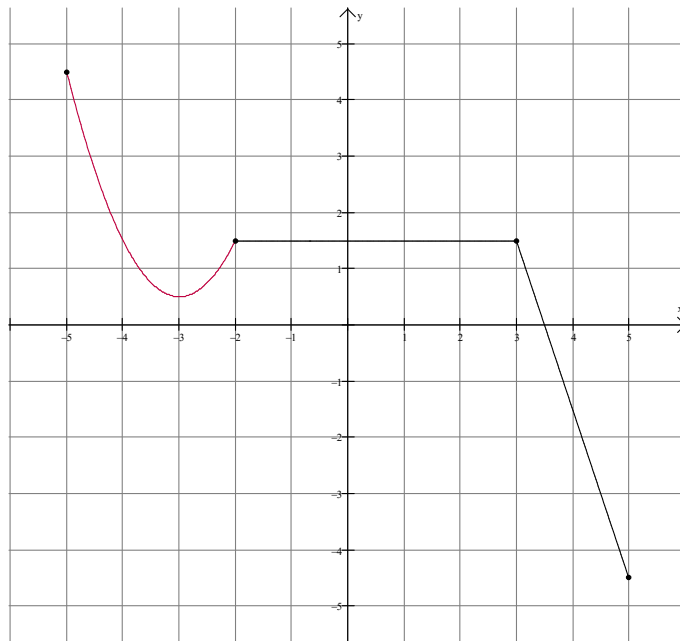
19. Determine the slope of the secant line containing the points  $(a, g(a))$  and  $(3, g(3))$ . Simplify your answer.

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

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  $F$

$$[-5, 5]$$

22. Range of  $F$

$$[-4.5, 4.5]$$

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

$$(-5, -3) \quad (3, 5)$$

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

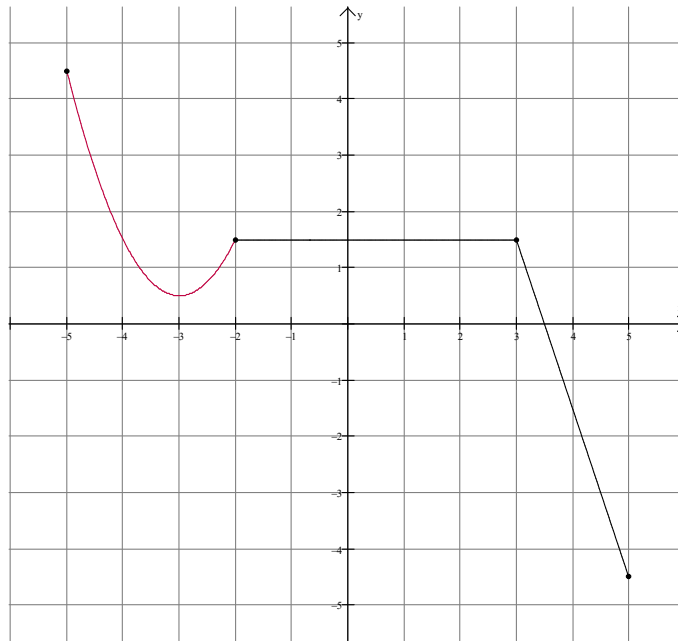
$$(-3, -2)$$

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

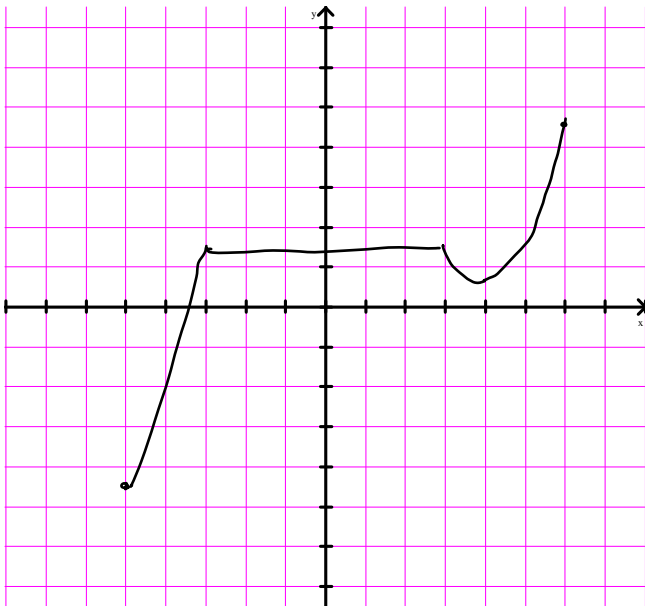
$$(-2, 3)$$

26. What type of extreme point is  $(-3, 0.5)$ ? Be specific.

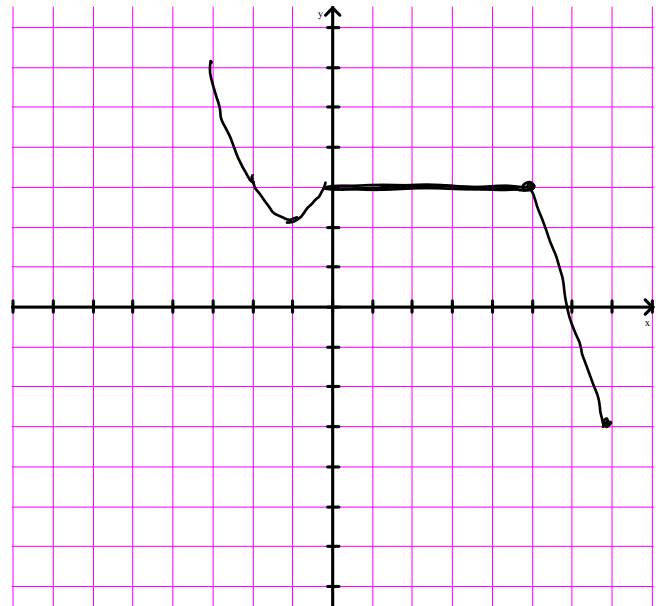
local min



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



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



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

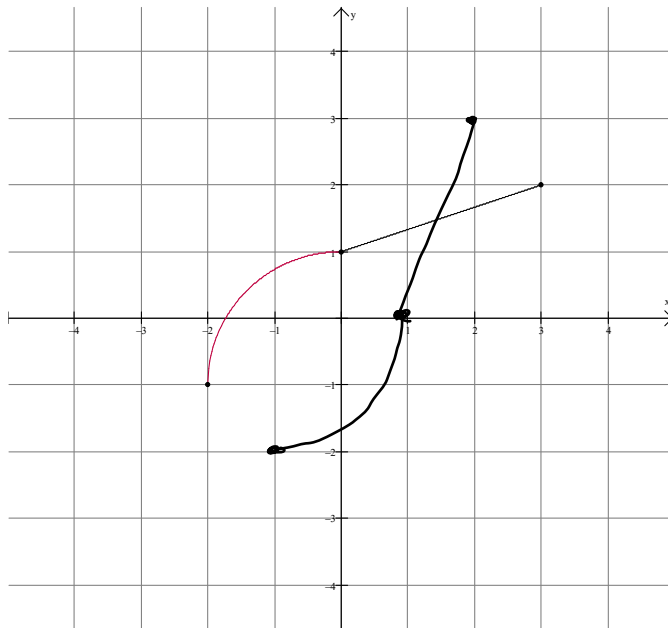
- (A)  $x_{\min} = -40, x_{\max} = 40, x_{\text{sc}1} = 4, y_{\min} = -40, y_{\max} = 40, y_{\text{sc}1} = 4$
- (B)  $x_{\min} = -40, x_{\max} = 40, x_{\text{sc}1} = 4, y_{\min} = -10, y_{\max} = 10, y_{\text{sc}1} = 1$
- (C)  $x_{\min} = -10, x_{\max} = 10, x_{\text{sc}1} = 1, y_{\min} = -40, y_{\max}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

C

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

- (A)  $x_{\min} = -5$ ,  $x_{\max} = 5$ ,  $x_{\text{sc1}} = 0.5$ ,  $y_{\min} = -5$ ,  $y_{\max} = 5$ ,  $y_{\text{sc1}} = 0.5$
- (B)  $x_{\min} = -5$ ,  $x_{\max} = 5$ ,  $x_{\text{sc1}} = 0.5$ ,  $y_{\min} = -10$ ,  $y_{\max} = 10$ ,  $y_{\text{sc1}} = 1$
- (C)  $x_{\min} = -10$ ,  $x_{\max} = 10$ ,  $x_{\text{sc1}} = 1$ ,  $y_{\min} = -5$ ,  $y_{\max} = 5$ ,  $y_{\text{sc1}} = 0.5$
- (D)  $x_{\min} = -20$ ,  $x_{\max} = 20$ ,  $x_{\text{sc1}} = 2$ ,  $y_{\min} = -10$ ,  $y_{\max} = 10$ ,  $y_{\text{sc1}} = 1$
- (E)  $x_{\min} = -10$ ,  $x_{\max} = 10$ ,  $x_{\text{sc1}} = 1$ ,  $y_{\min} = -20$ ,  $y_{\max} = 20$ ,  $y_{\text{sc1}} = 2$

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)

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

