

Multiple Choice - **NOTE: There may be more than one answer to each of these.**

1. Given the equations below, the graphs of which of the following will contain horizontal asymptotes?

- A. $f(x) = x^2$ B. $f(x) = x - 2$ C. $f(x) = \frac{1}{x}$ D. $f(x) = \ln x$ E. $f(x) = \sqrt{x}$

2. Given the equations below, the graphs of which of the following will contain vertical asymptotes?

- A. $f(x) = x^2$ B. $f(x) = x - 2$ C. $f(x) = \frac{1}{x}$ D. $f(x) = \ln x$ E. $f(x) = \sqrt{x}$

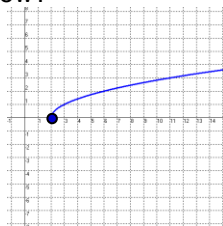
3. Which of the following equations does NOT have range of $(-\infty, \infty)$?

- A. $f(x) = 6$ B. $f(x) = 2^x$
 C. $f(x) = -x^4 - 3x^3 + 4$ D. $f(x) = x^3 - x^2 + x + 1$
 E. $f(x) = x^2$

4. Which of the following are asymptotes of $f(x) = \frac{2}{x-3}$?

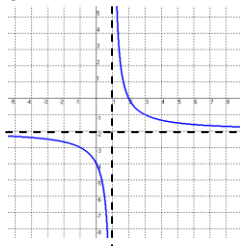
- A. $x = 0$ B. $x = 3$ C. $x = 2$ D. $y = 0$ E. $y = 3$

5. Which of the equations represents the graph below?



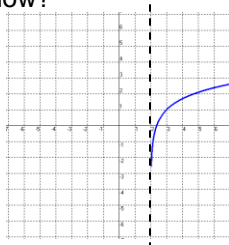
- A. $f(x) = x^2$ B. $f(x) = \left(\frac{1}{2}\right)^x$ C. $f(x) = \ln(x-2)$ D. $f(x) = \frac{1}{x-2}$ E. $f(x) = \sqrt{x-2}$

6. Which of the equations represents the graph below?



- A. $f(x) = \frac{2}{x-1} + 2$ B. $f(x) = \frac{2}{x-2} - 1$ C. $f(x) = \frac{2}{x-1} - 2$ D. $f(x) = \frac{2}{x+1} - 2$ E. $f(x) = \frac{2}{x+1} + 2$

6. Which of the equations represents the graph below?



- A. $f(x) = \ln(x-2) - 1$ B. $f(x) = \ln(x+2) - 1$ C. $f(x) = \ln(x-2) + 1$ D. $f(x) = \ln(x+2) + 1$ E. $f(x) = 2\sqrt{x-2} - 1$

7. The graphs of which equation(s) below will pass through the third quadrant?

- A. $f(x) = 2x - 30$ B. $f(x) = 2^x$ C. $f(x) = \sqrt{x+3} - 4$ D. $f(x) = -x^4 - x^3 + x$ E. $f(x) = \frac{-1}{x}$

8. The graphs of which equation(s) below will pass through the second quadrant?

- A. $f(x) = 7x - 50$ B. $f(x) = 7x$ C. $f(x) = x^2$ D. $f(x) = -2 - x^2$ E. $f(x) = (x - 2)^2$

9. Which of the following equations will have a maximum and/or a minimum?

- A. $f(x) = x^2$ B. $f(x) = \sqrt{x-2}$ C. $f(x) = x^3$ D. $f(x) = \ln(x-1)$ E. $f(x) = |x-4|$

10. Which of the following is/are NOT elements of the domain of $f(x) = \ln(3x+5)$?

- A. -3 B. -2 C. -1 D. 0 E. 1

11. The graphs of which equation(s) below will pass through the fourth quadrant?

- A. $f(x) = 2^x$ B. $f(x) = x^2 - 4$ C. $f(x) = (x-1)^2 + 4$ D. $f(x) = (x+1)^2 - 4$ E. $f(x) = \frac{3}{x+1}$

12. Which of the following is/are NOT elements of the range of $f(x) = \frac{2}{x-2}$?

- A. -1 B. 0 C. 1 D. 2 E. 3

13. Which of the following is/are NOT elements of the range of $f(x) = |x+2| - 2$?

- A. -2 B. -1 C. 0 D. 1 E. 2

14. Which of the following is/are NOT in the range of $f(x) = |x+2| - 2$?

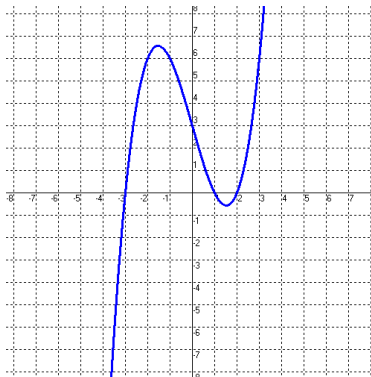
- A. -5 B. -3 C. -1 D. 1 E. 3

15. Find the x-intercepts of the graph of $f(x) = \frac{4(x-1)(x-2)(x-3)}{(x-5)}$

- A. 1 B. 2 C. 3 D. 4 E. 5

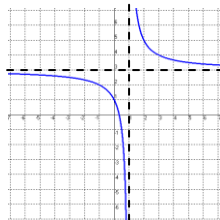
Free Response

16. Given the graph below:



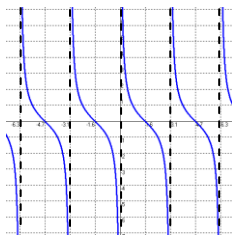
- A. Find the maximum value of the function.
 B. Find the zeros of the function.
 C. Identify all values of x for which there is a relative maximum.
 D. Identify the **type** of function which is graphed.

17. Given the graph below:



- Using interval notation, state the domain of the function.
- Using interval notation, state the range of the function.
- Write the equation of the horizontal asymptote.
- Write the equation of the vertical asymptote.
- Identify the **type** of function which is graphed.
- Write the equation of the function.

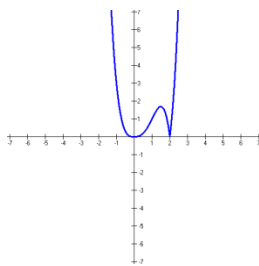
18. Given the graph below:



Note: x-coordinate grid marks occur every $\frac{\pi}{2}$

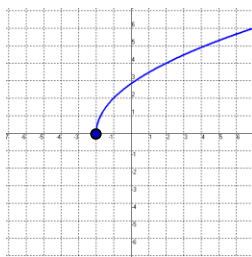
- Using interval notation, state the range of the function.
- Find the zeros of the function.
- Identify the **type** of function which is graphed.
- Find ONE interval over which the graph of the function is concave down.
- Find ONE interval over which the graph of the function is concave up.

19. Given the graph below:



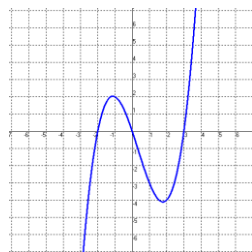
- Using interval notation, state the range of the function.
- Find the zeros of the function.
- Identify the **type** of function which is graphed.
- On what interval(s) is the function concave up?
- Where is the minimum of the function?
- Find the x-coordinate of the relative maximum of the function.

20. Given the graph below:



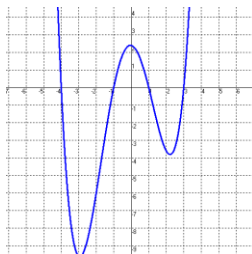
- State the domain of the function.
- State the range of the function.
- Find the value of the function when $x = 3$.
- Identify the **type** of function which is graphed.
- Write the equation(s) of the asymptote(s) of the function.
- For what values of x is $f(x) < 0$?

21. Given the graph below:



- Where is the relative maximum of the function?
- Where is the relative minimum of the function?
- Identify the **type** of function which is graphed.
- State the domain of the function.
- Find the zeros of the function.
- On what interval(s) is $f(x)$ concave up?

22. Given the graph below:



- State the domain of the function.
- Identify the **type** of function which is graphed.
- Find the zeros of the function.
- Where is the relative maximum of the function?
- What is the relative minimum of the function?
- Where are the relative minima of the function?
- What are the relative minima of the function?