

General test instructions: Show all your work on this test paper! If you solve a problem algebraically show all your steps. If you solve a problem by graphing on your calculator, show a sketch of the graph, with the solution labeled. **Where appropriate, round answers to 3 decimal places.**

1. Solve: $x^2 + 8x = 4$
2. Solve: $x = \sqrt{15 - 2x}$
3. Solve this system of equations.
 $9x + 3y = 1$
 $3x - 6y = 5$
4. Solve this system of equations.
 $x^2 = y - 1$
 $y = 3x + 5$
5. One day a chemist needed a 20% solution of potassium permanganate. She had a 15% solution on hand as well as a 30% solution. How many liters of the 15% solution should she add to 3 liters of the 30% solution to get her 20% solution?
6. Solve: $|2 - 7m| - 1 < 4$
7. Solve: $x^2 - x - 12 \geq 0$
8. Evaluate:
 - a. $5 \ln e^3 =$
 - b. $\log_4 25 =$
9. Solve: $5e^{-x} + 5 = 23$
10. Solve: $\log(x) + \log(x + 15) = 2$
11. John invested \$600 at 5.5% compounded continuously.
 - a. How long would it take John to triple his money?
 - b. How much money will John have at the end of 10 years?
12. a. Graph $f(x) = \log_2 x$ and
 $g(x) = \log_2(x - 1) + 3$
(Label intercepts and asymptotes.)

b. Describe how the graph of $g(x)$ differs from that of $f(x)$ in terms of transformations such as shifts up or down, left or right.
13. Write an equation of a third degree polynomial with a negative leading coefficient and zeros -2 , 3 , and 1 .
14. List all real zeros (including the multiplicity for each) for the following polynomials:
 - a. $f(x) = x^3 - 3x + 2$
 - b. $f(x) = 2x(2x + 3)(x^2 - 1)$
15. A company has found that the annual revenue from sales of cell phones is a function of the unit price, p , that it charges. If the revenue, R , is
 $R(p) = -150p^2 + 12,000p$
 - a. What price should be charged to maximize revenue?
 - b. What is the maximum revenue?
16. Analyze the function $f(x) = \frac{2x^2}{x^2 - 4}$
 - (a) y-intercept(s)
 - (b) x-intercept(s)
 - (c) vertical asymptote(s)
 - (d) horizontal asymptote(s)
 - (e) graph $y = f(x)$; include x and y-intercepts and all asymptotes.

17. Simplify; write in the standard $a + bi$ form.

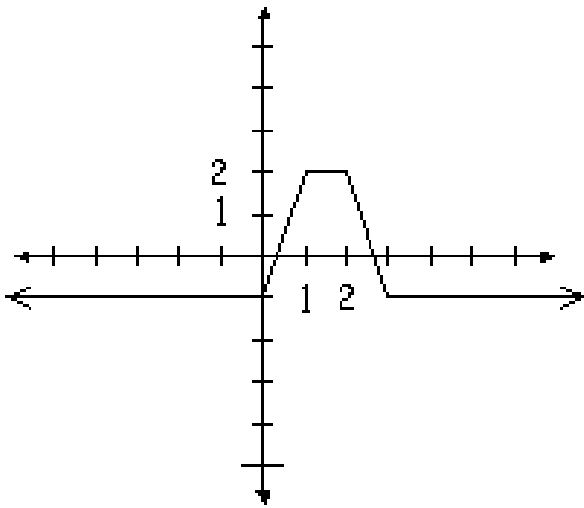
$$\frac{2+4i}{1-2i}$$

18. Find ALL real and complex zeros of the polynomial function

$$F(x) = (x^2-1)(x^2 + 4x + 5)$$

19. The graph of $y = f(x)$ is shown. On the same set of axes, sketch the graph of

$$y = -f(x + 2).$$



20. Given the function $g(x) = \sqrt{x-2}$, what is its

- domain?
- range?
- What is the inverse function of $g(x)$?
- Graph $g(x)$ and $g^{-1}(x)$.

21. Given

$$f(x) = 5 - x \text{ and } g(x) = x^2 + 4 \text{ find:}$$

- $f(-11)$
- $(f \circ g)(-4)$
- $(g \circ f)(x)$.

22. Find an equation of the line that passes through the point $(2, -1)$ and is perpendicular to the line $6x - 3y = 15$.

23. The following data represent the population of a colony of bacteria during a 10 day period.

| Time (days) | Population |
|-------------|------------|
| 0 | 1250 |
| 2 | 840 |
| 4 | 560 |
| 6 | 380 |
| 8 | 250 |
| 10 | 170 |

- Using a graphing utility, draw a scatter diagram.
- Find the line of best fit to the data.
Write the linear function here:
- Fit an exponential curve to the data.
Write the exponential function here:
- On the same axes as your scatter-plot in part a, graph the best fit line and the best fit exponential curve. Which of the two models fits the data better?
- Using the model you chose in part (d), estimate the population of the colony at 12 days.

24. Given the four functions f , g , h and k :

$$f(x) = |x+1|, \quad g(x) = -(x)^2 + 3, \quad h(x) = \sqrt{x+1},$$

$$\text{and } k(x) = \frac{3x}{x^2 + 1}$$

- Which function or functions have an inverse function? (That is, which function(s) are one-to-one?)
- Which function or functions are even? (That is, which are symmetric with respect to the y -axis?)
- Which function or functions are increasing on the interval $(-1, \infty)$?

25. a. Graph the function

$$F(x) = \begin{cases} x^2, & \text{if } x \leq 1 \\ 2, & \text{if } x > 1 \end{cases}$$

- Evaluate $f(0)$
- Evaluate $f(3)$