

REVIEW - UNIT 3

FORMULAS TO MEMORIZE:

- 1) Slope of the line through (x_1, y_1) and (x_2, y_2) : $m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$.
- 2) If m is the slope of a reference line, then $m_{\parallel} = m$ and $m_{\perp} = -\frac{1}{m}$ ($m \neq 0$).
- 3) Equation of a line with slope m through the point (x_1, y_1) : $y - y_1 = m(x - x_1)$.
- 4) Equation of the line with x - and y -intercepts a and b : $\frac{x}{a} + \frac{y}{b} = 1$ ($a \neq 0, b \neq 0$)
- 5) Average rate of change of f over the interval $[a, b]$ is $\frac{f(b) - f(a)}{b - a}$.

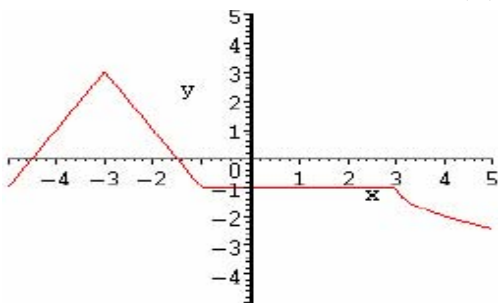
1. Solve the systems of equations: a) $5x - 3y = 2$ b) $x^2 + y^2 = 17$
 $x + 2y = 4$ $3y - x = 1$

2. The difference of two numbers is 12. The first number is 3 units more than twice the second. Find the numbers.

3. If $f(x) = \frac{x}{2x+1}$, find and simplify the difference quotient $\frac{f(x+h) - f(x)}{h}$.

4. Find the average rate of change of $f(x) = \frac{1}{1-x}$ over the interval $[-3, -1]$.

5. The graph of the function $y = f(x)$ is given.



- 1) Determine the largest (open) intervals where the function is increasing, decreasing, or constant.
- 2) Give three points that are on the graph.
- 3) Are the points $(-3, 3)$, $(-1, 2)$, $(1, -1)$ on the graph?
- 4) Is the function continuous?

6. Write the equation of the line passing through point $(-6, -3)$ and parallel to the line through $(-1, 2)$ and $(\frac{1}{2}, 4)$. Give the final answer in a standard form.
7. Write the equation of the line through the point $(\frac{3}{5}, -2)$ perpendicular to the line $3x - 2y = 6$. Give the final answer in the slope-intercept form. What is the y -intercept?
8. Find the equation of the line with the x -intercept -5 and y -intercept -15 . Write the answer in standard form.
9. A company has been selling 100 units of a product a week at \$50 each. The market survey indicates that for each \$3 rebate, the number of units sold increases by 4 per week.
 - a) Express the price p as a linear function of the demand x .
 - b) Use expression for p to find the number of units sold during a week if the price was \$35 per unit.
 - c) Find the revenue function $R(x)$.

10. (a) The piecewise function $f(x) = \frac{x^3 + x}{|x|}$ is given.

- (1) Find the domain and range of f .
- (2) Find intercepts (if they exist).
- (3) What type of symmetry, if any, does the function have?
- (4) Is the function odd, even, or neither?

(b) Sketch the graph of the function. Find the largest open intervals of continuity.

11. Find the domain and all intercepts of the function $y = \frac{x^2 - 5}{\sqrt{x^2 - 4}}$.

12. List all reflections, translations and stretching that are needed in order to obtain the graph of $f(x) = -2\sqrt{-x} + 1$ from the graph of $y = \sqrt{x}$. Find the domain of f and sketch its graph. What is the range of $f(x)$?

13. What types of symmetries does the relation $1 + xy^3 = x^2\sqrt{1 - y^2}$ have?

14. Classify the following functions as even, or odd, or neither even nor odd:

a) $f(x) = x^3 - 2x^2$ b) $f(x) = \frac{1}{\sqrt{x^2 + 5}}$ c) $f(x) = \frac{x^2 + 1}{x^3 - x}$ d) $f(x) = |x|$

15. Name two functions f and g such that $(f \circ g)(x) = (5x^2 - 3x + 4)^{\frac{3}{2}}$.

16. Let $f(x) = \frac{1}{x^2}$ and $g(x) = \sqrt{1 - x}$. Find:

a) $(f + g)(x)$, $(f \cdot g)(x)$, $\left(\frac{f}{g}\right)(x)$ and their domains

b) $\left(\frac{f}{g}\right)(-3)$ c) $(f \circ g)(0)$

d) $(f \circ g)(x)$, $(g \circ f)(x)$ and their domains.

17. Let $g(x) = \sqrt{x^2 - 16}$ and f be an even function such that the point $(-3, 5)$ lies on the graph of f . Find: (a) $(g \circ f)(-3)$ (b) $(f \circ g)(5)$.

18. Which of the following relations define y as a function of x :

a) $x - 2y = 35$ b) $y^2 - 2 = 3x$ c) $y = \sqrt{x^2 + 9}$ d) $y^3 - 4x - 1 = 0$.

19. Sketch the graph of the piecewise defined function:

$$f(x) = \begin{cases} -x & \text{if } x < -2 \\ 2 & \text{if } -2 \leq x \leq 0 \\ |x - 3| & \text{if } x > 0 \end{cases}$$

Give the largest open intervals where the function is increasing, decreasing, or constant. On which intervals is the function continuous?