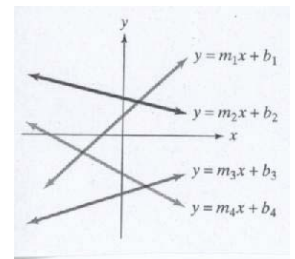


PRECALCULUS PROBLEM SESSION #2 - PRACTICE PROBLEMS

Linear Functions and Slope

- Find the slope of the line passing through (4, 1) and (3, -1) or state that the slope is undefined and then indicate whether the line through the points rises, falls, is horizontal, or is vertical.
- Write the equation of the line in $y = mx + b$ format.
 - Slope = 8, passing through (4, -1)
 - Passing through (3, 5) and (8, 15)
- Find the slope and y-intercept of $y = -\frac{2}{5}x + 6$ and $y = 3x + 2$ and then graph.
- Write in slope-intercept form, find the slope and y-intercept, and graph:
 - $4x + 6y + 12 = 0$
 - $2x = -4y + 6$
- Determine conditions on A, B, and C so that the linear equation $Ax + By = C$ can be written in each of the following forms, and discuss the possible number of x and y intercepts in each case.
 - $y = mx + b$, $m \neq 0$
 - $y = b$
 - $x = a$
- Why is it necessary to include the restriction $m \neq 0$ in the statement “a linear function $f(x) = mx + b$ with $m \neq 0$ has exactly one zero”?
- Graph $y = mx - 1$ for $m = -2, -1, 0, 1, 2$ simultaneously in the same coordinate system. Verbally describe the geometric significance of m .
- Use the figure below to list the y-intercepts $b_1, b_2, b_3,$ and b_4 in order of decreasing



size.

More on Slope

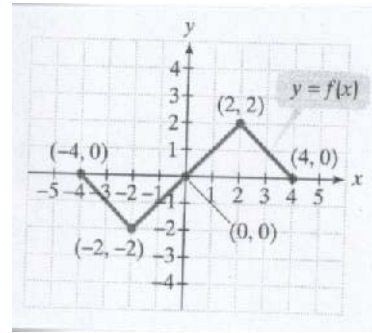
- Write in standard form the equation of a line that is perpendicular to the line $Ax + By = C$ and that passes through the origin.
- Write an equation in point-slope form and general form:
 - the line passing through $(-1, 3)$ parallel to the line whose equation is $3x - 3y - 5 = 0$.
 - the line passing through $(-2, 7)$ parallel to the line whose equation is $y = -5x + 4$.
 - the line passing through $(5, -9)$ perpendicular to the line whose equation is $x + 7y - 12 = 0$.
- The slope of a line perpendicular to a given line is equal to the negative multiplicative inverse of the slope of the given line. Write the equation of both lines if they intersect at the origin.
- Find the average rate of change of the function from x_1 to x_2 .
 - $f(x) = x^2 - 2x$ from $x_1 = 3$ to $x_2 = 6$
 - $f(x) = \sqrt{x}$ from $x_1 = 9$ to $x_2 = 16$

5. The displacement (in meters) of a particle moving in a straight line is given by $s(t) = t^2 - 5t - 14$, where t is measured in seconds. Find the average velocity over each time interval below:
- (i) $[3, 4]$ (ii) $[3.5, 4]$ (iii) $[3.9, 4]$
6. Find a linear function in slope-intercept form that models the description. "The percentage of Americans, $P(x)$, who regularly used the news outlet x years after 2000." If in 2000, 23% of Americans regularly used online news for getting news and this percentage has increased at an average rate of approximately 1.3 per year since then.

Function Transformations

1. Use the graph of $y = f(x)$ to graph each function g .

- a) $g(x) = f(x + 1)$ b) $g(x) = f(x + 1) - 2$
 c) $g(x) = f(-x)$ d) $g(x) = -f(x) + 1$
 e) $g(x) = \frac{1}{2}f(x)$



2. First graph the standard quadratic function $f(x) = x^2$ then use transformations of this graph to graph the following functions.

- a) $g(x) = x^2 - 1$ b) $g(x) = (x - 1)^2$ c) $h(x) = (x - 1)^2 + 2$ d) $g(x) = \frac{1}{2}(x - 1)^2$

3. First graph the absolute value function, $f(x) = |x|$, then use transformations to graph $h(x) = |x + 3| - 2$.

4. First graph the standard cubic function, $f(x) = x^3$, then use transformations to graph $g(x) = (x - 2)^3$

5. First graph the cube root function, $f(x) = \sqrt[3]{x}$, then use transformations to graph $g(x) = \sqrt[3]{x} - 2$

6. First graph the square root function, $f(x) = \sqrt{x}$, then use transformations to graph $h(x) = -\sqrt{x + 1}$

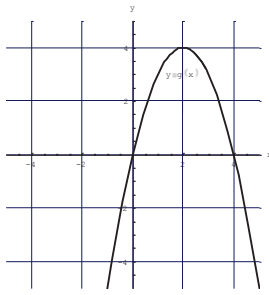
7. a) Given $f(x) = x^2$, which of the following represent graphs that are reflections about the x -axis for $f(x)$.

- i) $f(x) = -x^2$ ii) $f(x) = (-x)^2$ iii) $f(x) = -(x - 2)^2$

- b) Given $f(x) = |x|$, which of the following represent graphs that are reflections about the x -axis:

- i) $y = -|x|$ ii) $y = |-x|$

8. The graph of $y = g(x)$ in the figure below is a transformation of the graph of $y = x^2$. Find an equation for the function g .



9. Is the graph of $f(x) = \sqrt{-x}$ a reflection of $f(x) = \sqrt{x}$ about the x -axis or y -axis?
10. Given that the coordinates of a point on the unit circle are (a, b) what would be the coordinates of the point's reflection over the x -axis? Over the y -axis? Through the origin?
11. Let $f(x) = |x|$.
- Graph $y = f(x) + k$ for $k = -2, 0,$ and 1 simultaneously in the coordinate system. Describe the relationship between the graph of $y = f(x)$ and the graph of $y = f(x) + k$ for k , any real number.
 - Graph $y = f(x + h)$ for $h = -2, 0,$ and 1 simultaneously in the same coordinate system. Describe the relationship between the graph of $y = f(x)$ and the graph of $y = f(x + h)$ for h , any real number.

Combinations of Functions and Composite Functions

In problems 1-2, for the indicated functions f and g , find the functions $f + g$, $f - g$, fg , and f/g .

1. $f(x) = x - 1$ $g(x) = x - \frac{6}{x-1}$ 2. $f(x) = 6x^2 - x - 1, g(x) = x - 1$

3. Find the domain of each function

a) $f(x) = \sqrt{x+2}$ b) $f(x) = 2(x+5)$ c) $g(x) = \frac{2}{x+5}$ d) $g(x) = \frac{1}{\sqrt{x+2}}$

4. Find $(f \circ g)(x)$ and its domain.

a) $f(x) = \frac{5}{x-3}$ $g(x) = \frac{1}{x}$ b) $f(x) = \sqrt{x}, g(x) = x - 3$

5. For the following two functions find $(f \circ g)(x)$ and $(g \circ f)(x)$ and the respective domains of the compositions:

$$f(x) = x - 1 \quad \text{and} \quad g(x) = \sqrt{9 - x^2}$$