KFUPM – PREP MATH PROGRAM – MATH001 – TERM 241

2.1 Recitation Exercises

1. Find the domain of the function.

a) $f(x) = \sqrt{|x-5|}$

b) $f(x) = \frac{x^2}{\sqrt{6-x}}$

c) $f(x) = \frac{\sqrt{x+1}}{x}$

2. Find the range of the function.

a) $f(x) = -\sqrt{x+2}$

b) $f(x) = 1$

c) $f(x) = -|x-3| - 3$

3. If $f(x) = \sqrt{x}$, then find the difference quotient $\frac{f(1+h)-f(1)}{h}$, where $h \neq 0$.

4. A tank holds 50 gal of water, which drains from a leak at the bottom, causing the tank to empty in 20 min. The tank drains faster when it is nearly full because the pressure on the leak is greater. **Torricelli's Law** gives the volume of water remaining in the tank after t minutes as

$$V(t) = 50\left(1 - \frac{t}{20}\right)^2; \quad 0 \leq t \leq 20$$

(a) Find $V(0)$ and $V(20)$

(b) What do your answers to part (a) represent?

(c) Find the net change in the volume V as t changes from 0 min to 20 min.

5. In a certain state the maximum speed permitted on freeways is 65 mi/h, and the minimum is 40 mi/h. The Fine F for violating these limits is \$15 for every mile above the maximum or below the minimum.

(a) Complete the expressions in the following piecewise defined function, where x is the speed at which you are driving.

$$F(x) = \begin{cases} \_\_\_\_\_ & \text{if } \ 0 < x < 40 \\ \_\_\_\_\_ & \text{if } \ 40 \le x \le 65 \\ \_\_\_\_\_ & \text{if } \ x > 65 \end{cases}$$

(b) Find $F(30)$, $F(50)$, and $F(75)$.

(c) What do your answers in part (b) represent?

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2.2 & 2.3 Recitation Exercises

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1. Sketch the graph of the function $f(x) = |x| - x$.

2. Consider the function $f(x) = \begin{cases} |x| - 1 & \text{if } x < -2 \\ -x^2 - 1 & \text{if } -2 \le x < 2 \\ 3 & \text{if } x \ge 2 \end{cases}$

a) Sketch the graph of f.

b) Find the domain and the range of f.

c) Find the x-intercept(s) and y-intercept.

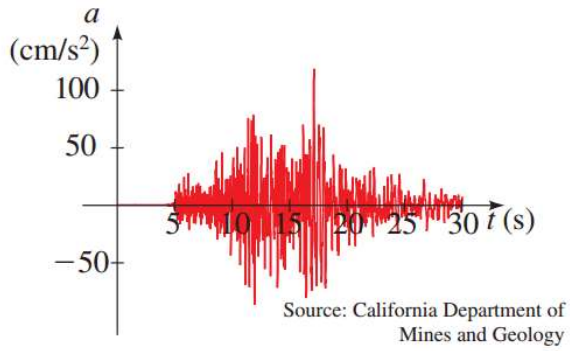
3. The 2014 domestic postage rate for first-class letters weighing 3.5 oz or less is 49 cents for the first ounce (or less), plus 21 cents for each additional ounce (or part of an ounce). Express the postage P as a piecewise defined function of the weight x of a letter, with $0 < x \le 3.5$.

4. **Earthquake**: The graph shows the vertical acceleration of the ground from the 1994 Northridge earthquake in Los Angeles, as measured by a seismograph. (Here t represents the time in seconds.)

(a) At what time t did the earthquake first make noticeable movements of the earth?

(b) At what time t did the earthquake seem to end?

(c) At what time t was the maximum intensity of the earthquake reached?



Source: California Department of Mines and Geology

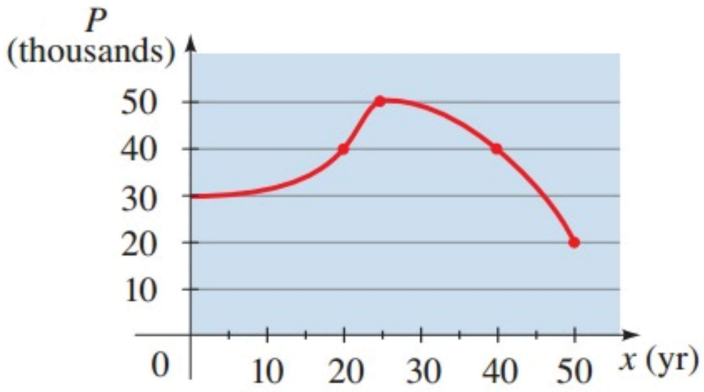
5. **Population Growth and Decline**:

The graph shows the population P in a small industrial city from 1950 to 2000. The variable x represents the number of years since 1950.

a. Determine the intervals on which the function P is increasing and on which it is decreasing.

b. What was the maximum population, and in what year was it attained?

c. Find the net change in the population P from 1970 to 1990.



2.5 Recitation Exercises

1. Let $f(x)$ be a linear function such that $f(0) = -3$ and the graph of $f(x)$ is perpendicular to the line $x + 2y = 3$. Find $f(-3)$

2. If f is a linear function such that $f(0) = k - 1,\ f(2) = k - 2$ and $f(6) = 1 - k$, then find the value of k.

3. The amount of copper ore produced from a copper mine in Arizona is modeled by the function $f(x) = 200 + 32x$ where x is the number of years since 2005 and $f(x)$ is measured in thousands of tons.

(a) What is the slope of the graph?

(b) At what rate is the amount of ore produced changing?

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2.6 Recitation Exercises

1. If the graph of the function $y = g(x)$ below is obtained from the graph of $f(x) = x^2$, then which one of the following equations is TRUE about the graph of g.

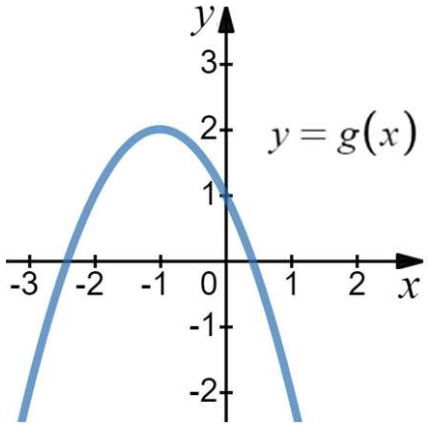
A) $g(x) = -f(x+1) + 2$

B) $g(x) = -f(x+1) + 1$

C) $g(x) = f(x-1) + 2$

D) $g(x) = -f(x-1) + 2$

E) $g(x) = f(x+1) + 1$



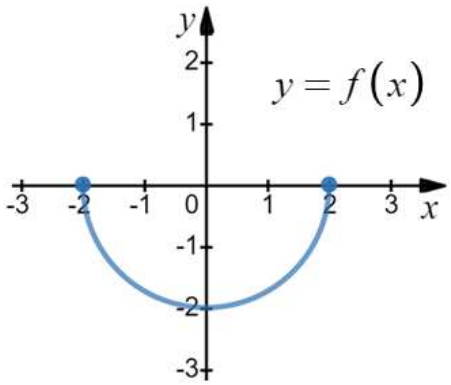
2. **a)** Describe how the graph of $g(x) = -2\sqrt{x+2} - 3$ can be obtained from the graph of $f(x) = \sqrt{x-2} + 2$.

b) If the graph of $g(x) = x^2 - 2x + 1$ is reflected across the y-axis, translated two units right, one unit down, and reflected across the x-axis, then write the new equation.

3. Sketch the graph of $f(x) = 1 - \sqrt{4-x}$ using transformations of functions.

4. If $f(-4) = 2$, then find the coordinates of the point that lie on the graph of $g(x) = -2f(-x-1) - 2$.

5. If the figure below is the graph of $y = f(x)$, then



a) sketch the graph of $g(x) = -\frac{1}{2} f\left(\frac{x}{2}\right)$,

b) find the domain D and the range R of g.

6. Which one of the following statements is TRUE?

A) $f(x) = x + \frac{1}{x}$ is an even function.

B) $f(x) = 1 - \sqrt[3]{x}$ is neither even nor odd.

C) $f(x) = 3x^3 + 2x^2 + 1$ is an odd function.

D) $f(x) = 2x^3 - 3|x|^5 + 5$ is an even function.

E) $f(x) = \frac{\sqrt{4x - x^3}}{x^7 + 1}$ is an odd function.

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2.7 Recitation Exercises

1. If $f(x) = x + k$, $g(x) = [\![x]\!]$ and the graph of the function $(gof)(x)$ has y-intercept $= 3$, then find all the values of k.

2. If $f(x) = x + 4$ and $(f \circ g)(x) = 12 + 8x + 2x^2$, then $g(2) =$

a. 4 **B)** 6 **C)** 36 **D)** 40 **E)** 32

3. **a)** If $f(x) = \sqrt{9 - x^2}$ and $g(x) = x^2 - 2x - 8$, then find the domain of $\left(\frac{f}{g}\right)(x)$.

b) Find the domain of $(f \circ g)(x)$, where $f(x) = \frac{x-1}{3-x}$ and $g(x) = \sqrt{x + 2}$.

4. **Multiple Discounts**

An appliance dealer advertises a 10% discount on all his washing machines. In addition, the manufacturer offers a \$100 rebate on the purchase of a washing machine. Let x represent the sticker price of the washing machine.

(a) Suppose only the 10% discount applies. Find a function f that models the purchase price of the washer as a function of the sticker price x.

(b) Suppose only the \$100 rebate applies. Find a function g that models the purchase price of the washer as a function of the sticker price x.

(c) Find $f \circ g$ and $g \circ f$. What do these functions represent? Which is the better deal?