

Show work where work is required. This can be worth partial credit. You may find the following formulas helpful:

1. (+4) Rewrite each real number using exponents.

1a. $\sqrt{7} = \boxed{7^{1/2}}$

1b. $\sqrt[3]{7^4} = \boxed{7^{4/3}}$

2. (+2) Rewrite the real number without using negative exponents or decimals:

$3^{-2} = \boxed{\frac{1}{3^2}}$

3. (+2) Rewrite the real number without using fractions or decimals:

$\frac{1}{2^3} = \boxed{2^{-3}}$

4. (+3) In problems 4a - 4c, classify each number. Circle all correct answers.

4a. -7 : (i) natural number (ii) integer (iii) rational number (iv) real number

4b. $\sqrt{7}$: (i) natural number (ii) integer (iii) rational number (iv) real number

4c. $49^{1/2}$: (i) natural number (ii) integer (iii) rational number (iv) real number
 $= \sqrt{49} = 7$

5. (+4) Use the following table to answer problems 5a-5c. This table shows the population of the The Woodlands-Conroe urbanized area from 1990 to 2010.

x (elapsed years from 1990)	90	100	110
y (population in thousands)	87	152	240

5a. What calendar year does $x = 100$ correspond to? year 2000

5b. Choose an appropriate viewing window for a scatter plot of this data.

[-80, 120, 10] by [-80, 250, 10] Answers may vary.

6. (+4) The population of persons with Asian ancestry in Harris County grew from 174,626 in 2000 to 253,392 in 2010.

+3 6a. Find the percent change in the population from 2000 to 2010. Show your work and then interpret your answer.

$\% \text{ change} = \frac{\text{last} - \text{first}}{\text{first}} \times 100$

$\% \text{ change} = \frac{253,392 - 174,626}{174,626} \times 100 = 45.1\%$

The population increased by 45.1% from 2000 to 2010.

+1 6b. Use the Midpoint Formula to estimate this population in 2005..

$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$

$M = \left(\frac{2000 + 2010}{2}, \frac{174,626 + 253,392}{2} \right) = (2005, 214,009)$

In 2005, there were 214,009 people with Asian ancestry in Harris county.

7. (+9) The following table shows the number of cases of meningitis reported in the state of Texas over the last 10 years for which data is available. Meningitis is an infectious disease of the central nervous system that can be fatal. The variable y represents the number of cases, and x stands for the elapsed number of years since 2000.

x (elapsed years from 2000)	0	1	2	3	4	5	6	7	8	9
y (number of cases)	230	250	220	175	195	90	140	200	125	95

7a. Is this table a function? Yes No

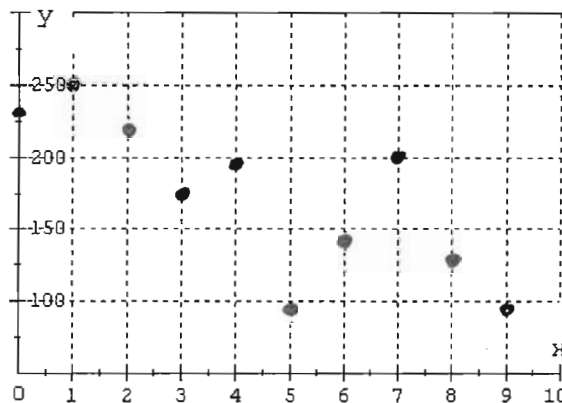
Explain your answer.

Each input (x) matches exactly one output (y).

7b. What is the graphing window shown at the right?

[0 , 10 , 0.5] by [50 , 300 , 50]

7c. Make a scatter plot of this table on the set of axes shown at the right.



8. (+4) Which ~~one~~ of the following tables is *not* a function? Explain.

constant

a.	Input	-4	-2	0	2	4
	Output	3	3	3	3	3

b.	Input	-4	-2	0	0	4
	Output	-3	-1	0	1	5

$x=0$ matches two outputs ($y=0$ and $y=1$)

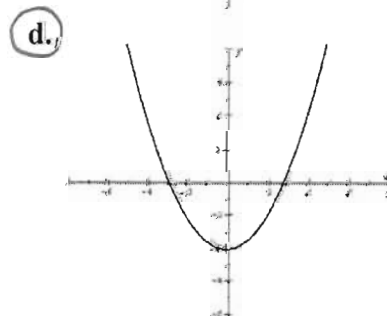
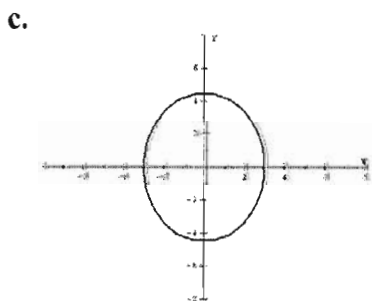
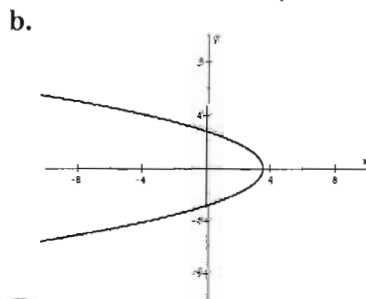
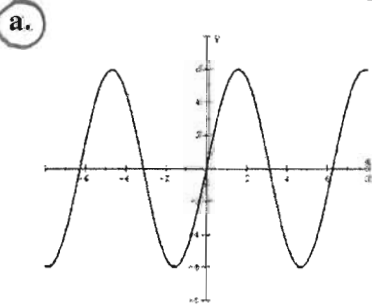
c.	Input	-4	-2	0	2	4
	Output	-4	-2	0	2	4

d.	Input	-4	-2	0	2	2
	Output	3	2	-1	-1	-2

$x=2$ matches two outputs ($y=-1$ and $y=-2$)

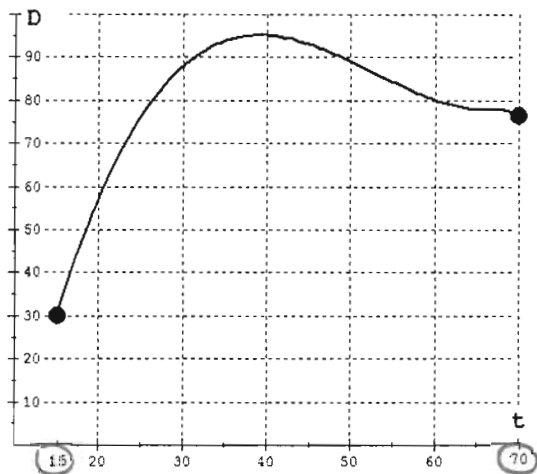
linear

9. (+4) Which of the following graphs are functions? Circle your answer(s).



10. (+3) Fill in the blanks: If $f(-2) = 7$, then the point $(-2, 7)$ lies on the graph of f .

11. (+9) The following graph shows the percentage of the population D in the U.S. who are licensed drivers at age t .



11a. Write the domain of the function D using interval notation.

$[15, 70]$

11b. What is the practical meaning of the expression $D(30)$? Do not evaluate.

The percentage of 30-year-olds who are licensed drivers.

11c. Express the following information in function notation: The percentage of the population at age 60 in the U.S. who are licensed drivers is 80%.

$$D(60) = 80$$

12. (+4) Use the function $f(x)$ to answer problems 12a-12b: $f(x) = \frac{8}{4x + 20}$. Show your work.

12a. Evaluate $f(1)$. If not possible, write undefined. $f(1) = \frac{8}{4(1)+20} = \frac{8}{4+20} = \frac{8}{24} = \frac{1}{3}$

12b. Write the domain of the function f . $\text{all real numbers except } -5$

Denominator cannot be zero

$$4x + 20 = 0$$

$$\begin{array}{r} -20 \\ -20 \end{array}$$

$$\frac{4x}{4} = \frac{-20}{4}$$

$$x = -5$$

13. (+4) Use the function $f(x)$ to answer problems 13a-13b: $f(x) = \sqrt{x-3}$. Show your work.

13a. Evaluate $f(0)$. If not possible, write undefined. $f(0) = \sqrt{0-3} = \sqrt{-3} \rightarrow$ UNDEFINED

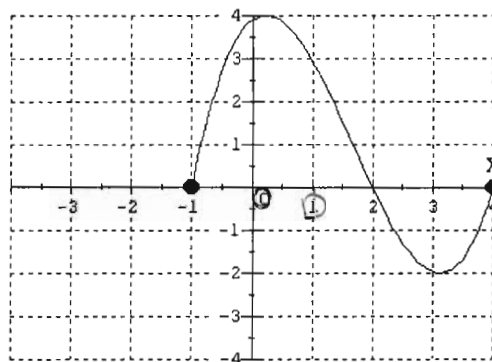
13b. Write the domain of the function f . $x \geq 3$ or $[3, \infty)$
 RADICAND CANNOT BE NEGATIVE

14. (+4) Use the function $f(x)$ to answer problems 14a-14b: $f(x) = x^2 + 2x$. Show your work.

14a. Evaluate and simplify: $f(x+3)$
 $f(x+3) = (x+3)^2 + 2(x+3)$
 $= (x+3)(x+3) + 2x+6 = x^2 + 8x + 15$
 $= x^2 + 3x + 3x + 9 + 2x + 6$

14b. Write the domain of the function f . all real numbers

15. (+8) Use the graph of the function f shown here to answer the following questions 15a-15d.



15a. Carefully estimate $f(0) \approx$ 3.9

15b. Carefully estimate $f(1) \approx$ 2.9

15c. Carefully estimate all values of x such that $f(x) = 0$.
 $x = -1, 2, 4$ $y = 0$

15d. Write the range of the function f .
 $[-2, 4]$

16. (+4) Which of the following functions are linear? Circle all correct answers.

i.

x	0	1	2	3
y	3	5	6	9

 \checkmark \checkmark \checkmark

ii.

x	0	1	2	3
y	0	-3	-6	-9

 \checkmark \checkmark \checkmark

iii.

x	0	1	2	3
y	2	2.1	2.2	2.3

 \checkmark \checkmark \checkmark

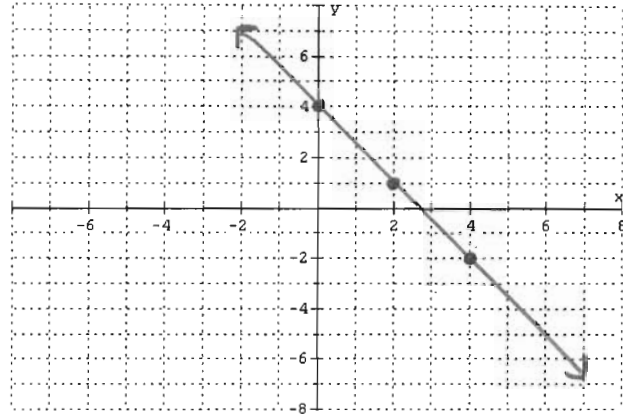
iv.

x	0	1	2	3
y	10	8	10	8

 \checkmark \checkmark \checkmark

17. (+4) Graph the function $y = -\frac{3}{2}x + 4$ on the set of axes shown here.

X	Y
0	4
2	1
4	-2



18. (+4) The following linear function shows the recommended dosage of a certain drug (in mg) for a patient weighing x pounds.

$$y = 0.15x + 5$$

- 18a. What is the slope?

- 18b. Write a sentence to state the practical meaning of the slope of the line.

The dosage increases by 0.15 mg per pound of body weight.

19. (+4) A line passes through the points $(-5, -10)$ and $(2, 4)$. Find the slope of the line. Show your work.

slope =

$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{4 - (-10)}{2 - (-5)} = \frac{14}{7} = 2$$

20. (+4) The temperature of a cup of soup is 65°F when it is put in the microwave. The temperature then begins to increase at a steady rate of 12°F per minute. Let y be the temperature of the soup x minutes after it is put in the microwave. Write a formula for this function. $y =$

65°F - initial temp
 $12^\circ\text{F}/\text{minute}$ - slope

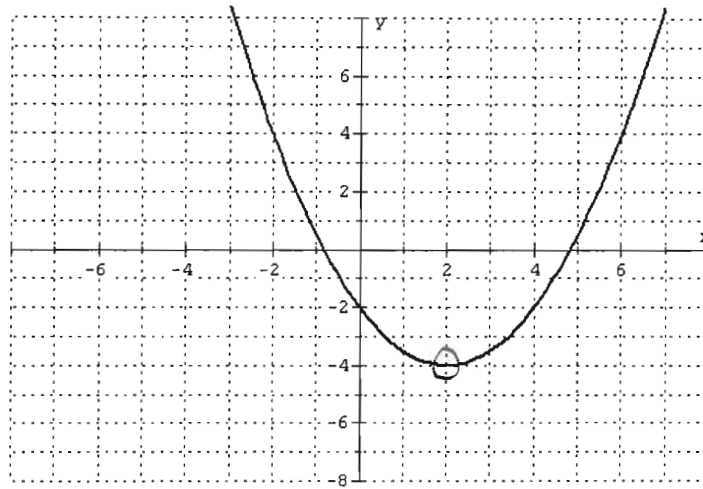
21. (+4) The maximum number of bonus points y that Professor Zorba awards for a make-up on a test is a function of a student's original score x on the test. The higher the original score, the fewer bonus points can be given. Professor Zorba uses the formula

$$y = -\frac{2}{5}x + 40$$

- What is the y -intercept of this function? y -int. = Interpret this value in the context of the problem.

The most number of bonus points that can be received is 40.

22. (+4) Describe where the function graphed here is increasing, decreasing, and constant using interval notation.

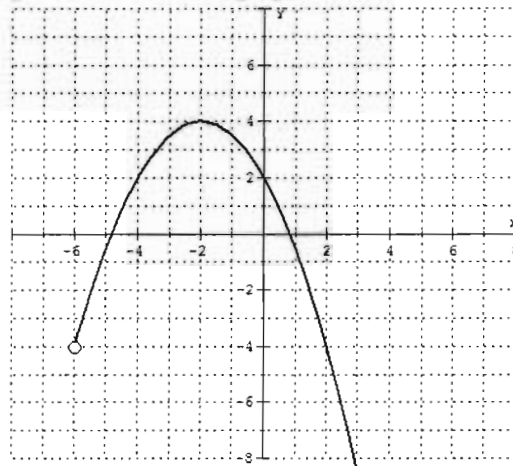


Increasing:

Decreasing:

Constant:

23. (+4) Write the domain and range of the function graphed here using interval notation.



Domain:

Range: