

1. On the number line, what is the distance between:
 - a. 5 and -15?
 - b. 5 and y ?
2. On the number line, what points are at distance 3 from -1?
3. On the number line, what point is halfway between:
 - a. 2 and its opposite?
 - b. 2 and its reciprocal?
 - c. x and y ?
4. The midpoint of the segment from (x, y) to $(8, -6)$ is the point $(4, 0)$. What are the values of x and y ?
5. On graph paper, show as many points as possible that are at distance 12 from the origin, using:
 - a. taxicab distance
 - b. Euclidean distance
6. Given the two points $(-2, 5)$ and $(7, -3)$, find:
 - a. the taxicab distance between them
 - b. the slope of the line that joins them
 - c. the Euclidean distance between them
7. Find the length of the diagonal of a square if the side of the square is:
 - a. 5
 - b. y
8. Find the length of the side of a square if the diagonal is:
 - a. 5
 - b. y
9. What is the area of a rectangle having sides:
 - a. 5 and $\sqrt{10}$
 - b. $\sqrt{5}$ and $\sqrt{10}$
 - c. $2\sqrt{5}$ and $3\sqrt{10}$
 - d. $(2 + \sqrt{5})$ and $3\sqrt{10}$
10. A rectangle has area $12\sqrt{5}$. Give three possibilities for the sides.
11. Write in simplest radical form.
 - a. $\sqrt{20}$
 - b. $\sqrt{40}$
 - c. $\sqrt{60}$
 - d. $\sqrt{80}$
 - e. $\sqrt{100}$
12. Simplify, then add or subtract.
 - a. $\frac{2}{\sqrt{2}} + \sqrt{8}$
 - b. $15 - \sqrt{35} + \sqrt{25} - \sqrt{45}$
 - c. $\frac{3}{\sqrt{2}} + \sqrt{16} + \sqrt{50}$
 - d. $\sqrt{3^5} + \frac{3}{\sqrt{3}}$

13. According to the U.S. Census Bureau, the population of Texas was 11,198,655 in 1970 and 14,225,513 in 1980. Estimate the population in 1975 assuming that during that decade the population was growing:
- linearly
 - exponentially

Chapter 9 • Additional Problems

- Give a value of x for which:
 - $\sqrt{-x}$ is not a real number
 - $\sqrt{-x}$ is a real number
 - $\sqrt{-x} = \sqrt{x}$
- Evaluate for $x = \frac{1}{2}$
 - x^2
 - $(-x)^2$
 - $-x^2$
 - x^{-2}
- True or False? Explain your answer, giving examples.
 - $\sqrt{x}\sqrt{y} = \sqrt{xy}$
 - $\sqrt{x}\sqrt{x} = x$
 - $\sqrt{x} + \sqrt{y} = \sqrt{x+y}$
 - $(\sqrt{x} + \sqrt{y})^2 = x + y$
 - $\frac{1}{\sqrt{x}} + \frac{1}{\sqrt{y}} = \frac{1}{\sqrt{x+y}}$
- On dot paper, draw and label segments of the lengths given.
 - $\sqrt{17}$
 - $\sqrt{10}$
 - $\sqrt{5}$
 - $\sqrt{2}$
- On dot paper:
 - Sketch a square having area 20 and a square having area 5.
 - Explain how your sketch can be used to show that $\sqrt{20} = 2\sqrt{5}$.

Assume that the amount of material needed to make clothes is proportional to the surface area, while the amount of food needed is proportional to the volume.

- In *Gulliver's Travels*, Gulliver is six feet tall and the Lilliputians are six inches tall.
 - Gulliver is how many times as tall as a Lilliputian?
 - Gulliver will need how many times as much material for clothes as a Lilliputian?
 - Gulliver will need how many times as much food as a Lilliputian?

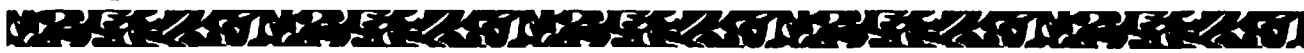
Chapter 10 • Test

Name _____


- Solve each system. Check first to see if the system has no solution or an infinite number of solutions.
 - $$\begin{cases} 2x + 7y = 28 \\ y = 3x + 4 \end{cases}$$
 - $$\begin{cases} m + n = 4 \\ 2m = 8 - 2n \end{cases}$$
 - $$\begin{cases} 5a - 8b = 13 \\ a + 2b = 8 \end{cases}$$
 - $$\begin{cases} 6x - 11y = 16 \\ 4x + y = -6 \end{cases}$$
- Create a system of equations that has the solution $x = -4, y = 11$. Explain your strategy for making up a system of equations having a given solution.
- A line passes through the points $(3, 7)$ and $(-1, -5)$.
 - Find two more points on this line.
 - Is $(5, 13)$ on the line? How do you know?
 - Write the equation of the line passing through these points.
- Write the equation of a line having slope $\frac{1}{2}$ that passes through
 - $(10, 6)$
 - $(-6, -10)$
- The equations of six lines are given below. Find all possible pairs of parallel lines. Show how you solved this problem.
 - $y = 2x - 4$
 - $8y - 16x = 12$
 - $x + y = 9$
 - $y = 6 - x$
 - $8x - 8y = 12$
 - $20x = 10y$
- Hillary owns and manages a small corner grocery store. She has a standing daily order with Chelsea's Creamery for 48 quarts of milk and 36 half-gallons of milk. Her daily bill is usually \$77.76. On January 20th her bill was larger than usual. She had been charged \$81.84. By doing a quick calculation, she figured out that she had been accidentally charged for 48 half-gallons and 36 quarts. How much does Chelsea's Creamery charge for each quart and each half-gallon?
- Graph $x + 2y = 10$ and $x + y = 10$ on the same axes.
 - Which graph is steeper?
 - Do the graphs ever intersect? If so, where?

Chapter 10 • Additional Problems

1. If these two lines are parallel, what is t ?
 $y = \frac{2}{t}x + 4$ $y = \frac{t}{8}x + 7$
2.
 - a. Sketch three different rectangles, each having perimeter 80.
 - b. Sketch three rectangles, each having length 5 more than the width.
 - c. Find a rectangle that satisfies both conditions above. Show all your work.
3. Find the equations of three lines that intersect at the point $(-3, 5)$. Explain your strategy.
4. On a business trip, Zoe rented a car from Peru's Budget Rental for three days and drove 173 miles. On another trip two weeks later, she again rented a car from Peru's. This time, she had the car for two days and drove 112 miles. Zoe paid \$79.45 for the first trip and \$52.30 for the second, excluding taxes and insurance. Peru's charges a certain amount per day plus a certain amount per mile after the first 50 miles per day. (There is no charge per mile for the first 50 miles per day.) How much does Peru's charge per day and per mile?
5. Warren drove a total of 105 miles in 2 hours and 45 minutes. He had done some driving on city roads, on which his speed averaged 25 miles per hour, and other driving on the highway, where it averaged 50 miles per hour. Estimate the amount of time he spent on highway driving and the number of miles he traveled on the highway.
6.
 - a. Graph $x + 2y = 8$, $x + 3y = 8$, and $x + 4y = 8$ on the same axes.
 - b. Label the x -intercept and y -intercept of each line.
 - c. Graph a line that is steeper than all three of these lines. Write its equation.
 - d. Graph a line that is not as steep as any of the three lines. Write its equation.
7. Write the equations of two lines that have the same x -intercepts.
8. Write the equations of two lines that have the same y -intercepts.



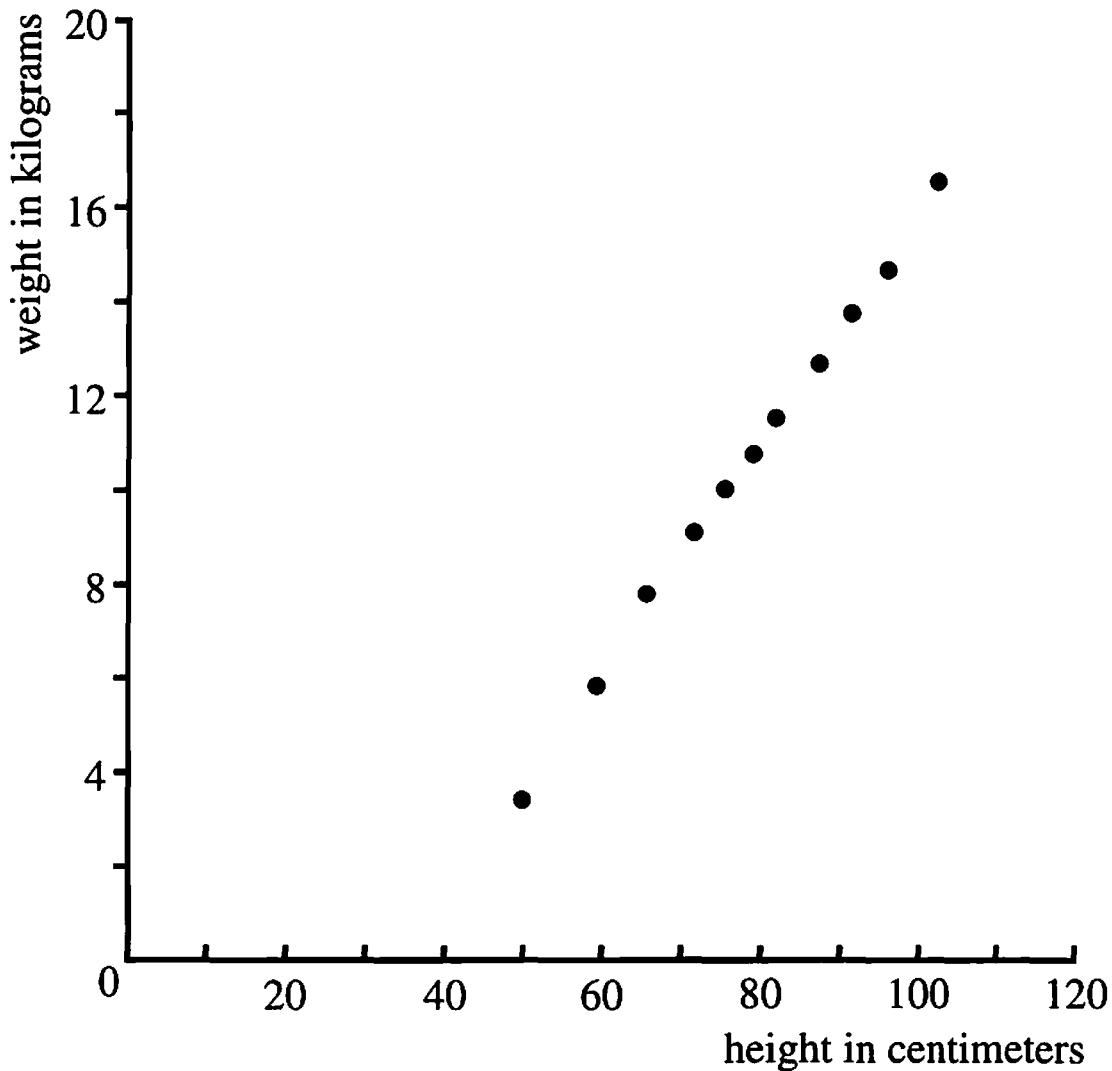
1. Find each sum.
 - a. $\frac{1}{5} + \left(\frac{1}{5}\right)^2$
 - b. $\frac{1}{5} + \left(\frac{1}{5}\right)^2 + \left(\frac{1}{5}\right)^3$
 - c. $\frac{1}{5} + \left(\frac{1}{5}\right)^2 + \left(\frac{1}{5}\right)^3 + \left(\frac{1}{5}\right)^4$
 - d. $\frac{1}{5} + \left(\frac{1}{5}\right)^2 + \left(\frac{1}{5}\right)^3 + \dots + \left(\frac{1}{5}\right)^n$
2. Estimate the sum of this infinite series.
 $\frac{1}{5} + \left(\frac{1}{5}\right)^2 + \left(\frac{1}{5}\right)^3 + \dots$
3. Some of the following sequences are geometric; find their common ratio. Some are arithmetic; find their common difference.
 - a. $\frac{3}{5}, \left(\frac{3}{5}\right)^2, \left(\frac{3}{5}\right)^3, \dots$
 - b. $12, \frac{12}{5}, \frac{12}{25}, \dots$
 - c. $\frac{1}{3}, \frac{10}{3}, \frac{19}{3}, \frac{28}{3}, \dots$
4. Find the sum of the first 50 terms of this sequence.
 $8, \frac{8}{4}, \frac{8}{16}, \frac{8}{64}, \dots$
5. For each sequence, decide whether or not the sum of the infinite sequence converges to a finite number. If it does, find the sum.
 - a. $8, \frac{8}{4}, \frac{8}{16}, \frac{8}{64}, \dots$
 - b. $1, 4, 16, 64, \dots$
 - c. $\frac{1}{3}, \frac{10}{3}, \frac{19}{3}, \frac{28}{3}, \dots$
6. Many people believe, incorrectly, that $\frac{1}{3} = 0.3$. Write the correct decimal representation of $\frac{1}{3}$.
7. By how much does the correct decimal representation of $\frac{1}{3}$ differ from 0.3? Write your answer as:
 - a. a fraction
 - b. a decimal
8. Find the reciprocal of 6.25. Write your answer as:
 - a. a fraction in simplest form
 - b. a decimal
9. Explain why, if $2p^2 = q^2$, p and q cannot both be integers.

10. If you choose a letter at random from the word ALGEBRA, what's the probability that it's a vowel?
11. Which game, if either, is fair? Explain.
- If you toss a penny, a nickel, and a dime, each coin will land either heads or tails. If the total value of the coins landing heads is 10 cents or more, Player A wins. Otherwise, Player B wins.
 - If you toss a penny, a nickel, a dime, and a quarter, each one will land either heads or tails. If the total value of the coins landing heads is 26 cents or more, Player A wins. Otherwise, Player B wins.
12. One *parsec* is the distance light travels in 3.26 years. Light travels 5.88 trillion miles in one year.
- How many miles in a parsec?
 - How many parsecs does light travel in one year?
13. a.  If you substitute whole numbers for x in the expression $\frac{1}{2x + 1}$, will you *always*, *sometimes*, or *never* get a rational number? Explain.
- b. If you substitute whole numbers for x in the expression $\frac{1}{2x + 1}$, will you *always*, *sometimes*, or *never* get a number that can be written as a terminating decimal? Explain.


1. Kim lives 18 miles from work. One day, it took her $\frac{1}{2}$ hour to get to work in the morning. She got caught in a traffic jam on her way home, and the return trip took her 2 and $\frac{1}{2}$ hours.
 - a. What was her average speed in miles per hour for the round trip?
 - b. How many minutes, on the average, did it take her to go one mile?
2. Find Kim's average speed for a trip in which she drove:
 - a. 18 miles at 45 mph and 18 miles at 60 mph
 - b. 18 miles at 45 mph and 180 miles at 60 mph
 - c. 180 miles at 45 mph and 18 miles at 60 mph
3.
 - a. Explain why none of your answers to problem 2 is equal to $\frac{45 + 60}{2}$, or 52.5.
 - b. Which answer is closest to 52.5? Which is closest to 45? Which is closest to 60? Why?
4. Gabe publishes a monthly magazine called *The Good News About Algebra*. He loses about 20% of his customers at the end of every school year, but gains about 85 more each September. How many customers will he end up with in the long run? Explain.

Dr. Terwit, a pediatrician, kept records of her son Joshua's height and weight from birth to age four years. You analyzed this table of data in Chapter 8.

Age	Height (cm)	Weight (kg)
birth	51	3.4
3 mos	60	5.7
6 mos	66	7.6
9 mos	71	9.1
12 mos	75	10.1
15 mos	79	10.8
18 mos	82	11.4
2 yrs	88	12.6
2.5 yrs	92	13.6
3 yrs	96	14.6
4 yrs	103	16.5



5. You should have a graph of the weight as a function of height. On this graph, use the median-median line method to fit a line.
6.
 - a. What is the equation of your fitted line?
 - b. What is the slope of your fitted line?
7. Use your equation to predict how much Joshua will weigh when he is 106 centimeters tall.
8. According to the data, Joshua weighed 10.8 kilograms when he was 79 centimeters tall. How does this compare with the weight predicted by your equation for a height of 79 centimeters?
9. According to your equation, how much weight does Joshua gain for every increase in height of one centimeter?

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- A pen is to be made having length 5 feet more than twice its width. If 70 feet of fencing is available to make the pen, what will its area be? Show your work. Include a sketch.
 - The perimeter of a rectangle is 85.
 - Find the dimensions that will give it an area of 100.
 - Find the dimensions that will give it the largest possible area.
 - Which graphs have the same x -intercepts? Explain.
 - $y = 4x(9 - x)$
 - $y = x(18 - 2x)$
 - $y = 2x(x - 9)$
 - $y = 6x(18 - 3x)$
 - $y = x(x - 6)$
 - $y = 6x(9 - 3x)$
 - How many x -intercepts does each have?
 - $y = 3x - 5$
 - $y = 3(x - 5)$
 - $y = (x - 3)(x - 5)$
 - $y = 5x^2 - 5$
 - $y = x^2 + 6x + 9$
 - $y = a(x - H)^2$
 - A movie theater has a bargain night every Tuesday during the summer. It charges \$2.50 for a double feature. The attendance is usually about 400 people. The manager thinks that he could increase attendance by reducing the admission fee. After conducting a survey in town, he concludes that with every 25-cent reduction in the admission fee, he could increase attendance by 50 people. How much should he charge for admission to maximize the amount of money he takes in? How many people would attend?
 - Write an equation of any parabola that fits the description.
 - The x -intercepts are $(-2, 0)$ and $(5, 0)$.
 - The vertex is $(-2, 6)$.
 - The y -intercept is $(0, -4)$.
 - The vertex is at $(4, -5)$ and one intercept is at $(3, 0)$.
 - Solve these equations.
 - $9x - x^2 = 20$
 - $x^2 - 12 = 0$
 - $x^2 - 12x = 0$
 - $x^2 - 12x = -10$
 - $x^2 - 12x = -9$
 - $x^2 - 12x - 9 = 0$

Chapter 13 • Additional Problems

1. Write the equations of three different parabolas that have x -intercepts $(2, 0)$ and $(-3, 0)$.
2. A parabola crosses the x -axis at $(-1, 0)$ and $(-5, 0)$ and has a vertex at $(-3, -2)$. Write three equivalent equations for this parabola.
3. You have a square having sides 22 cm in length. You want to cut a small square out of each corner and fold up the sides to make a tray.
 - a. If you want the base of the tray to be a 10-cm-by-10-cm square, what should be the size of the small squares that you cut out of each corner?
 - b. Find the volume and surface area of the resulting tray.
4. A photocopying service will make 3000 copies or fewer at the rate of \$5.00 per hundred copies. Customers who make large orders (over 3000 copies) may take advantage of the Discount Plan. The service gives a discount of 5 cents per hundred on the whole order for each hundred in excess of 3000.
 - a. Under the Discount Plan, a person who ordered 3300 copies would get a discount of 15 cents per hundred. What would be the total cost of the order?
 - b. What is the cost of the most expensive possible order? How many copies is it? (Hint: Use algebra or make a table.)
 - c. According to this plan, what would be the cost of 10,000 copies? What about 13,000 copies?
 - d. What restrictions would you advise the photocopying service to make on the Discount Plan? Explain.
5. Find two numbers whose product is 228 and whose sum is 31.
6. The sum of two numbers is 56. If their product is to be as great as possible, what are the two numbers?
7. Find the coordinates of the vertex.
 - a. $y = -4(x + 2)(x - 3)$
 - b. $y = (x + 2)^2 - 5$
 - c. $y = x^2 - 6x + 10$
8. Solve for x . $3(x + 2)(x - 5)(2x + 4) = 0$

1. Write a rational expression having a denominator of $12x$ that is equivalent to:
- a. $\frac{1}{12}$
 - b. 12
 - c. $12x$
 - d. $12y$

2. Find a common denominator and add.

a. $1 + \frac{6}{x}$ b. $y + \frac{4}{y}$ c. $\frac{6}{x} + \frac{4}{y}$

d. $\frac{b}{a} + \frac{b^2}{2a}$ e. $\frac{a}{b} + \frac{a}{c}$

In problems 3 through 11, simplify if possible.

3. $\frac{6a + 6b}{5a + 5b}$ 4. $\frac{3x + 3y}{x^2 - y^2}$ 5. $\frac{y^2 + 6y}{y^2 + 5y}$

6. $\frac{2}{2x + 2}$ 7. $\frac{2}{3x + 2}$ 8. $\frac{10x - 5}{5}$

9. $\frac{10n^2}{2n}$ 10. $\frac{3}{12a + 6b}$ 11. $\frac{2x + 2}{6x + 6}$

12. Tell whether each equation is *always*, *sometimes*, or *never* true. If it is sometimes true, illustrate by substituting numbers for x and y that make it true.

a. $\frac{2x + 2y}{2} = x + y$ b. $\frac{2x + 2y}{2x} = 2y$

c. $\frac{2x + 2y}{x + y} = 2$ d. $\frac{2x + 2y}{2} = x + 2y$

13. Consider the equation $5x^2 = 20x$.

- a. Explain why you can divide both sides by 5, but not by x .
- b. Solve the equation correctly.

14. Solve for x .

a. $1 + \frac{8}{x} = \frac{-7}{x^2}$ b. $1 + \frac{1}{x^2} = \frac{2}{x}$

c. $1 + \frac{6}{x} = \frac{-4}{x^2}$ d. $1 + \frac{6}{x} = \frac{4}{x^2}$

15. Give the vertex, x -intercepts, and y -intercept of:

a. $y = 3x^2 + 4x - 9$ b. $y = -4(x - 5)(x + 2)$

16. Write a quadratic equation that has the solutions $2 + \sqrt{7}$ and $2 - \sqrt{7}$.

17. 💡 The reciprocal of $x + 2$ is $\frac{1}{x+2}$. Find the result of these operations.

Write your answer as a single fraction in simplest form.

- a. Multiply $x + 2$ by its reciprocal.
- b. Add $x + 2$ to its reciprocal.
- c. Subtract $x + 2$ from its reciprocal.
- d. Divide $x + 2$ by its reciprocal.

18. 💡 Find the reciprocal of each expression.

- a. $\frac{x}{2}$
- b. $x + \frac{1}{2}$
- c. $2 + \frac{1}{x}$
- d. $1 + \frac{2}{x}$