MATH

GRADE 9
(Advanced)

Revision

Term 1
2019/2020

Chapter 1: Expressions, Equations and Functions

Lesson 1: Variables and Expressions

A) Write a verbal expression for each algebraic expression.

1. $13x$

2. 4^3

3. $5l^2 + 2$

4. $4s^2 - 10$

5. $x^3 \cdot y^4$

6. $d^2 - n^3$

B) Write an algebraic expression for each verbal expression.

1. the product of 18 and q

2. 6 more than twice m

3. 8 increased by three times a number

4. 15 decreased by twice a number

5. the difference of 10 and u

6. 91 more than the square of a number

7. three fourths the square of b

8. two fifths the cube of a number

Problem Solving:

The lateral area of a right cylinder can be found by multiplying twice the number π by the radius times the height. If a right cylinder has radius r and height h, write an expression that represents the lateral area.

Lesson 2: Order of Operations

A) Evaluate each expression.

1. $9 \bullet (3 + 4)$

2. $5 + 7 \bullet 4$

3. $4(1 + 5) - 5 \bullet 4$

4. $22 \div 11 \bullet 9 - 2^3$

5. $3[7 - (27 \div 9)]$

6. $\frac{7 + 3^2}{4^2 \bullet 2}$

7. $\frac{5^2 \bullet 4 - 5 \bullet 4^2}{5(4)}$

8. $\frac{(2 \bullet 5)^2 + 4}{3^2 - 5}$

B) Evaluate each expression if $a = 6$, $b = 3$, and $c = 2$.

1. $a^2 + b - c^2$

2. $b^2 + 2a - c^2$

3. $2c(a + b)$

4. $4a + 2b - c^2$

5. $[a^2 \div (4b)] + c$

6. $c^2 \bullet (2b - a)$

7. $\frac{bc^2 + a}{c}$

8. $\frac{2c^3 - ab}{4}$

Problem Solving:

The length of a rectangle is $2n + 3$ and its width is $n - 1$. The perimeter of the rectangle is twice the sum of its length and its width.

a. Write an expression that represents the perimeter of the rectangle.

b. Find the perimeter of the rectangle when $n = 2$ cm.

Lesson 4: The Distributive Property

A) Use the Distributive Property to rewrite each expression. Then evaluate.

1. $4(3 + 5)$

2. $5(7 - 4)$

3. $5 \cdot 89$

4. $(4 + 6)11$

5. $15 \cdot 104$

6. $9 \cdot 99$

7. $16\left(4\frac{1}{4}\right)$

8. $7 \cdot 110$

B) Use the Distributive property to rewrite each expression. Then simplify.

1. $(9 - p)3$

2. $(5y - 3)7$

3. $15\left(f + \frac{1}{3}\right)$

4. $16(3b - 0.25)$

5. $m(n + 4)$

6. $(c - 4)d$

C) Simplify each expression. If not possible, write *simplified*.

1. $x + 14x - 6x$

2. $3(5 + 6m)$

3. $12z^2 + 9z^2$

4. $25b^3 - 17b^3$

5. $3a^2 + 6a + 2a^2$

6. $4(6c + 2c - 2c)$

D) Write an algebraic expression for each verbal expression. Then simplify, indicating the properties used.

1. The product of 9 and t squared, increased by the sum of the square of t and 2

2. 3 times the sum of r and d squared minus 2 times the sum of r and d squared

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Problem Solving:
A family recently dined at an Italian restaurant. Each of the four family members ordered a pasta dish that cost AED 11.50, a drink that cost AED1.50, and dessert that cost AED 2.75.

a. Write an expression that could be used to calculate the cost of the Ross' dinner before adding tax and a tip.

b. What was the cost of dining out for the Ross family?

Chapter 2: Linear Equations

Lesson 1: Writing equations

A) Translate each sentence into an equation.

1. Fifty-three plus four times x is as much as 20.

2. The sum of five times a and twice b is equal to 23.

3. One fourth the sum of z and ten is identical to v minus 5.

4. Three plus the sum of the squares of y and x is 30.

5. Two added to three times a number b is the same as 10.

6. Twice r increased by the cube of z equals a.

7. Seven less than the sum of p and t is as much as 6.

8. The sum of x and its square is equal to y times z.

B) Translate each sentence into a formula.

1. The sum S of the measures of the angles of a polygon is equal to 180 times the difference of the number of sides n and 2.

2. The total cost C of gas is the price p per gallon times the number of gallons g.

3. The perimeter P of a triangle is equal to the sum of the lengths of sides a, b, and c.

4. The area A of a circle is pi times the radius r squared.

C) Translate each equation into a sentence.

1. $a + 3 = 3a$

2. $2n + 4t = 20$

3. $\frac{1}{3}(x + y) = x - 5$

4. $a^2 - b^2 = 2b$

Problem Solving:

- Dana is twice as old as her sister Fatima. The sum of their ages is 24. Write a one-variable equation to represent the situation.

- Mohamed and Khalid each go for walks around a lake a few times per week. Last week, Mohamed walked 7 miles more than Khalid. If K represents the number of miles Khalid walked, write an equation that represents the total number of miles T the two boys walked.

Lesson 2: Solving One-Step Equations

A) Solve each equation. Check your solution.

1. $19 + h = -4$

2. $-12 = k + 24$

3. $j + 1.2 = 2.8$

4. $m + (-8) = 2$

5. $w + \frac{3}{2} = \frac{5}{8}$

6. $5 = \frac{y}{12}$

7. $-\frac{1}{4}k = -2.5$

8. $-\frac{m}{8} = \frac{5}{8}$

9. $-25 = 5m$

10. $6m = 15$

11. $-1.5p = -75$

12. $\frac{a}{15} = \frac{4}{5}$

B) Write an equation for each sentence. Then solve the equation.

1. Negative eight times a number of equals –152.

2. Negative two sevenths of a number is $-\frac{3}{7}$.

3. Five ninths of a number is $-\frac{3}{10}$.

4. 2.7 times a number equals 8.37.

Problem Solving:

- Mr. Ahmad's farm is 350 km^2. Mr. Ahmad's farm is $\frac{1}{4}$ the size of Mr. Jassem's farm. How many square kilometers is Mr. Jassem's farm?

- On a cold January day, Malek noticed that the temperature dropped 21 degrees over the course of the day to –9ºC. Write and solve an equation to determine what the temperature was at the beginning of the day.

- A Chief Justice served on the Supreme Court for 33 years until his death in 2005. Write and solve an equation to determine the year he was confirmed as a justice on the Supreme Court.

Lesson 3: Solving Multi-Step Equations.

A) Solve each equation. Check your solution.

1. $-12a - 19 = 77$

2. $17 + 3x = 14$

3. $15y + 4 = 49$

4. $\frac{r}{5} + 6 = 2$

5. $\frac{z}{-4} + 3 = 15$

6. $\frac{u}{3} - 6 = -2$

7. $\frac{1}{2}y - \frac{1}{8} = \frac{7}{8}$

8. $-32 - \frac{3}{5}f = -17$

9. $8 - \frac{3}{8}k = -4$

10. $\frac{s+13}{12} = 1$

11. $\frac{15-f}{3} = -9$

12. $\frac{3m-7}{5} = 16$

13. $\frac{k}{7} - 0.5 = 2.5$

14. $2.5k + 0.45 = 0.95$

15. $0.4m - 0.7 = 0.22$

B) Write an equation and solve each problem.

1. Seven less than four times a number equals 26. What is the number?

2. Find two consecutive odd integers whose sum is 180.

3. Find two consecutive even integers whose sum is 178.

C) Solve each problem.

1. Three is added to a number, and then the sum is multiplied by 4. The result is 16. Find the number.

2. A number is divided by 4, and the quotient is added to 3. The result is 24. What is the number?

Problem Solving:

- While Majed sat observing birds at a bird feeder, one fourth of the birds flew away when they were startled by a noise. Two birds left the feeder to go to another stationed a few feet away. Three more birds flew into the branches of a nearby tree. Four birds remained at the feeder. How many birds were at the feeder initially?

- After Mohamed received his allowance for the week, he went to the mall with some friends. He spent half of his allowance on a new paperback book. Then he bought himself a snack for $1.25. When he arrived home, he had $5.00 left. How much was his allowance?

Lesson 4: Solving Equations with the Variable on Each Side

A) Solve each equation. Check your solution.

1. $2z + 12 = 3z - 31$

2. $2x - 8 = x + 17$

3. $4x - 9 = 7x + 12$

4. $-6y - 3 = 3 - 6y$

5. $5 + 3r = 5r - 19$

6. $-9 + 8k = 7 + 4k$

7. $\frac{1}{2}(3g - 2) = \frac{g}{2}$

8. $\frac{1}{3}(n + 1) = \frac{1}{6}(3n - 5)$

9. $\frac{1}{2}(5 - 2h) = \frac{h}{2}$

10. $\frac{1}{9}(2m - 16) = \frac{1}{3}(2m + 4)$

11. $3(8 - 3t) = 5(2 + t)$

12. $2(3u + 7) = -4(3 - 2u)$

13. $8(2f - 2) = 7(3f + 2)$

14. $5(-6 - 3d) = 3(8 + 7d)$

15. $6(w - 1) = 3(3w + 5)$

16. $7(-3b + 2) = 8(3b - 2)$

17. $\frac{2}{3}z - 6 = 6 - \frac{2}{3}z$

18. $\frac{1}{2} - \frac{5}{8}m = \frac{7}{8}m + \frac{7}{2}$

B) Solve each problem.

1. Two thirds of a number reduced by 11 is equal to 4 more than the number. Find the number.

2. Five times the sum of a number and 3 is the same as 3 times the difference of twice the number and 1. What is the number?

3. Tripling the greater of two consecutive even integers gives the same result as subtracting 10 from the lesser even integer. What are the integers?

Problem Solving:

- The formula for the perimeter of a rectangle is $P = 2\ell + 2w$, where ℓ is the length and w is the width. A rectangle has a perimeter of 24 inches. Find its dimensions if its length is 3 inches greater than its width.
- Mohamed's mother is twice as old as he is. She is also as old as the sum of the ages of Mohamed and both of his younger twin brothers. The twins are 11 years old. Solve the equation $2d = d + 11 + 11$ to find the age of Mohamed.
- A pair of angles is supplementary if the sum of their measures is 180º. A pair of angles is complementary if the sum of their measures is 90º. The supplement of a given angle is 10º more than twice its complement. Let $90 - x$ equal the degree measure of its complement and $180 - x$ equal the degree measure of its supplement. Write and solve an equation to find the measure of the given angle.

Lesson 5: Solving Equations Involving Absolute Value

A) Evaluate each expression if $a = 2$, $b = -3$, and $c = -4$.

1. $|a - 5| - 1$

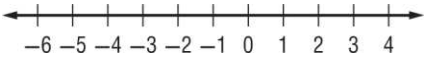
2. $|b + 1| + 8$

3. $5 - |c + 1|$

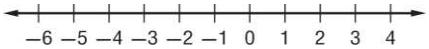
4. $|a + b| - c$

B) Solve each equation. Then graph the solution set.

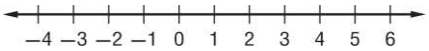
1. $|w + 1| = 5$



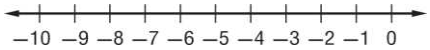
2. $|n + 2| = 1$



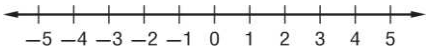
3. $|w - 2| = 2$



4. $|t + 6| = 4$



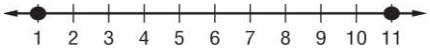
5. $|2z - 9| = 1$



6. $|2g - 5| = 9$

C) Write an equation involving absolute value for each graph.

1.



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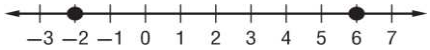


Problem Solving:

- Malek uses the elliptical cross–trainer at the gym. His general goal is to burn 280 Calories per workout, but she varies by as much as 25 Calories from this amount on any given day. Write and solve an equation to find the maximum and minimum number of Calories Malek burns on the cross-trainer.

- A thermometer is guaranteed to give a temperature no more than 1.2°F from the actual temperature. If the thermometer reads 28°F, write and solve an equation to find the maximum and minimum temperatures it could be.

- A certain scholarship and student loan fund uses a formula to determine whether or not a student qualifies for college funding. The formula is $|3k + 6| = 15$, where k is a need score determined by an interview. What are the possible need scores?

Lesson 6: Ratios and Proportions:

A) Determine whether each pair of ratios are equivalent ratios. Write *yes* or *no*.

1. $\frac{7}{6}, \frac{14}{42}$ **2.** $\frac{3}{11}, \frac{18}{77}$ **3.** $\frac{18}{24}, \frac{36}{48}$

4. $\frac{12}{11}, \frac{108}{99}$ **5.** $\frac{8}{9}, \frac{72}{81}$ **6.** $\frac{1.5}{9}, \frac{1}{6}$

7. $\frac{3.4}{5.2}, \frac{7.14}{10.92}$ **8.** $\frac{1.7}{1.2}, \frac{2.9}{2.4}$ **9.** $\frac{7.6}{1.8}, \frac{3.9}{0.9}$

B) Solve each proportion. If necessary, round to the nearest hundredth if needed.

1. $\frac{5}{c} = \frac{30}{54}$ **2.** $\frac{z}{46} = \frac{34}{23}$ **3.** $\frac{40}{56} = \frac{m}{7}$

4. $\frac{28}{49} = \frac{4}{x}$ **5.** $\frac{3}{g} = \frac{27}{162}$ **6.** $\frac{b}{3} = \frac{48}{9}$

6. $\frac{v}{0.23} = \frac{7}{1.61}$ **7.** $\frac{3}{0.72} = \frac{12}{b}$ **8.** $\frac{6}{n} = \frac{3}{0.51}$

9. $\frac{7}{a-4} = \frac{14}{6}$ **10.** $\frac{3}{12} = \frac{2}{y+6}$ **11.** $\frac{m-1}{8} = \frac{2}{4}$

12. $\frac{4}{b-2} = \frac{4}{12}$ **13.** $\frac{x}{1.5} = \frac{12}{x}$ **14.** $\frac{3+y}{4} = \frac{-y}{8}$

Problem Solving:

- Khalid's boat used 5 gallons of gasoline in 4 hours. At this rate, how many gallons of gasoline will the boat use in 10 hours?

- Majed paints a room that has 42 square meters of wall space in $2\frac{1}{2}$ hours. At this rate, how long will it take her to paint a room that has 72 square meters of wall space?

- Yusra finished 24 math problems in one hour. At that rate, how many hours will it take her to complete 72 problems?

Lesson 7: Percent of Change:

A) Determine whether each percent of change is a percent of *increase* or a percent of *decrease*. Then find the percent of change.

1. Original: AED100
New: AED 59

2. Original: 324 people
New: 549 people

2. Original: 58 Homes
New: 152 Homes

4. Original: 15.6 liters
New: 11.4 liters

5. Original: 231.2 mph
New: 236.4 mph

6. Original: AED 3.78
New: AED 2.50

B) Find the final price of each item. When there is a discount and sales tax, first compute the discount price and then compute the sales tax and final price.

1. DVD: AED 219
sales tax: 6.5%

2. jeans: AED 39.99
discount: 15%
sales tax: 4%

3. DVD: AED 219
sales tax: 6.5%

4. book: AED 19.95
discount: 5%
sales tax: 5%

5. skates: AED 99.99
discount: 20%
sales tax: 6.75%

6. boots: AED 59.00
discount: 10%
sales tax: 5.5%

Problem Solving:

- The World Future Society predicts that by the year 2020, airplanes will be able to carry 1400 passengers. Today's biggest jets can carry 600 passengers. What will be the percent of increase of airplane passengers?

- There were 134 people in attendance at the school football game last Friday. This week there were 246 people in attendance at the school football game. What is the percent of change from last week to this week?

- Ola scored 82 points on the first math test of the year. On the second math test, she scored 78 points. What is the percent of change in the number of points she scored between the first and second tests.

Lesson 8: Literal Equations and Dimensional Analysis

A) Solve each equation or formula for the variable indicated.

1. $7t = x$, for t

2. $r = wp$, for p

3. $q - r = r$, for r

4. $4m - t = m$, for m

5. $7a - b = 15a$, for a

6. $-5c + d = 2c$, for c

7. $x - 2y = 1$, for y

8. $d + 3n = 1$, for n

9. $\frac{x-c}{2} = d$, for x

10. $\frac{x-c}{2} = d$, for c

11. $\frac{p+9}{5} = r$, for p

12. $\frac{b-4z}{7} = a$, for b

13. $y = 7w - 2$, *for* w

14. $3\ell + y = 5 + 5\ell$, *for* ℓ

Problem Solving

- The volume of a box V is given by the formula $V = \ell wh$, where ℓ is the length, w is the width, and h is the height.
  a. Solve the formula for h.
  b. What is the height of a box with a volume of 50 cubic meters, length of 10 meters, and width of 2 meters?

- In uniform circular motion, the speed v of a point on the edge of a spinning disk is $v = \frac{2\pi}{t}r$, where r is the radius of the disk and t is the time it takes the point to travel once around the circle. Solve the formula for r.

- The distance d a car can travel is found by multiplying its rate of speed r by the amount of time t that it took to travel the distance. If a car has already traveled 5 miles, the total distance d is found by the formula $d = rt + 5$. Solve the formula for r.

- Simple interest that you may earn on money in a savings account can be calculated with the formula $I = prt$. I is the amount of interest earned, p is the principal or initial amount invested, r is the interest rate, and t is the amount of time the money is invested for. Solve the formula for p.

Lesson 9: Weighted averages

A) At 8:00 A.M., two groups of hikers begin 21 km apart and head toward each other. The first group, hiking at an average rate of 1.5 km per hour, carries tents, sleeping bags, and cooking equipment. The second group, hiking at an average rate of 2 km per hour, carries food and water. Let *t* represent the hiking time.

	r	***t***	***d = rt***
First group of hikers			
Second group of hikers			

a. Complete the table representing the problem.

b. Write an equation using t that describes the distances traveled.

c. How long will it be until the two groups of hikers meet?

B) Two trains leave Raleigh at the same time, one traveling north, and the other south. The first train travels at 80 km per hour and the second at 96 km per hour. Let *t* represent the time until the trains pass each other.

	r	***t***	***d = rt***
First Train			
Second Train			

a. Complete the table representing the problem.

b. In how many hours will the trains be 275 miles apart?

Problem Solving

- Two cyclists begin traveling in the same direction on the same bike path. One travels at 15 miles per hour, and the other travels at 12 miles per hour. When will the cyclists be 10 miles apar

- A pineapple drink contains 15% pineapple juice. How much pure pineapple juice should be added to 8 quarts of the pineapple drink to obtain a mixture containing 50% pineapple juice?

- Keith wants to create a drink that is 40% juice. How much of a 10% juice solution should he add to 100 milliliters of 100% grape juice to obtain the 40% mixture?

- Sprinter A runs 100 meters in 15 seconds, while sprinter B starts 1.5 seconds later and runs 100 meters in 14 seconds. If each of them runs at a constant rate, who is further in 10 seconds after the start of the race? Explain.

Chapter 3: Linear and Nonlinear functions

Lesson 1: Graphing linear equations

A) Determine whether each equation is a linear equation. Write *yes* or *no*. If yes, write the equation in standard form and determine the *x*- and *y*-intercepts.

1. $4xy + 2y = 9$

2. $8x - 3y = 6 - 4x$

3. $7x + y + 3 = y$

4. $5 - 2y = 3x$

5. $\frac{x}{4} - \frac{y}{3} = 1$

6. $\frac{5}{x} - \frac{2}{y} = 7$

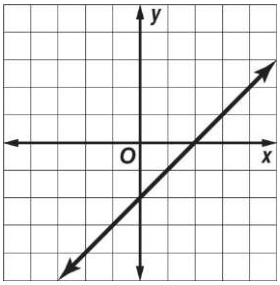
7. $\frac{1}{4}x - 12y = 1$

8. $3 + x + x^2 = 0$

9. $x^2 = 2x$

B) Find the *x*- and *y*-intercepts of each linear function.

1.



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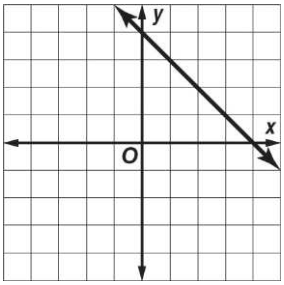
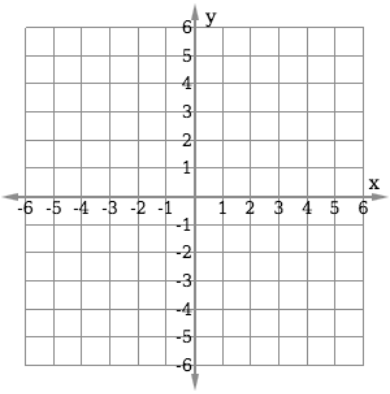


3.

Time, *x*	Distance, *y*
0	4
2	3
4	2
6	1
8	0

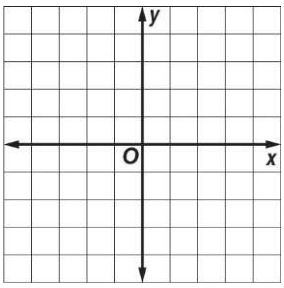
C) Graph $y - 2x = 1$ by making a table.

x	2*x* + 1	*y*	(*x*, *y*)
–2			
–1			
0			
1			
2			

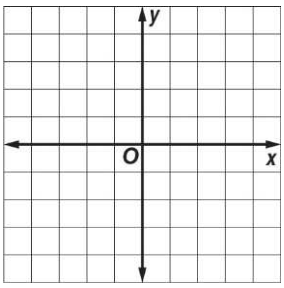


D) Graph each equation by making a table.

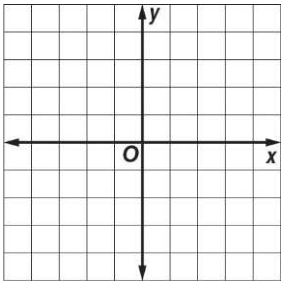
1. $y = 4$



2. $y = 3x$

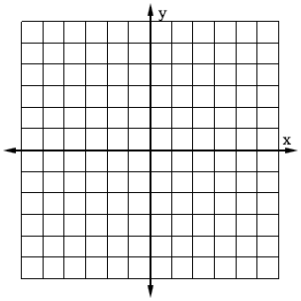


3. $y = x + 4$

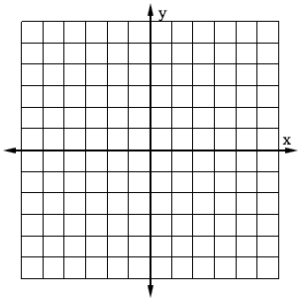


E) Graph each equation by using the *x*- and *y*-intercepts.

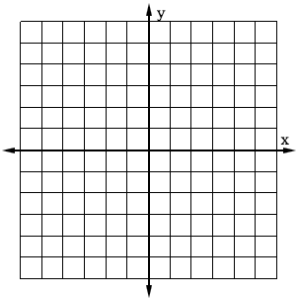
1. $x - y = 3$



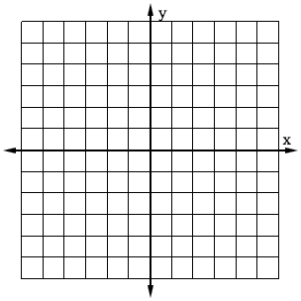
2. $10x = -5y$



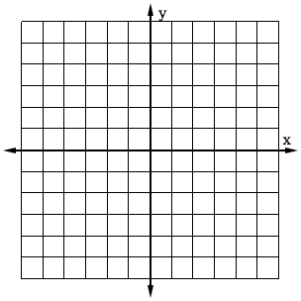
3. $4x = 2y + 6$



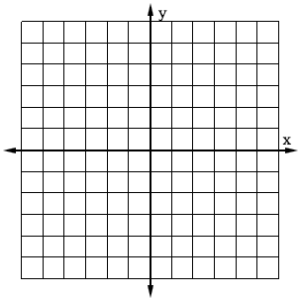
4. $\frac{1}{2}x - y = 2$



5. $5x - 2y = 7$



6. $1.5x + 3y =$



Problem Solving

- The equation $y = 1000x - 5000$ represents the monthly profits of a start-up dry cleaning company. Time in months is x and profit in dirhams is y. The first date of operation is when time is zero. However, preparation for opening the business began 3 months earlier with the purchase of equipment and supplies. Graph the linear function for x-values from
  –3 to 8.

- The height of a woman can be predicted by the equation $h = 81.2 + 3.34r$, where h is her height in centimeters and r is the length of her radius bone in centimeters.

  a. Is this is a linear function? Explain.
  b. What are the r- and h-intercepts of the equation?
  Do they make sense in the situation? Explain.

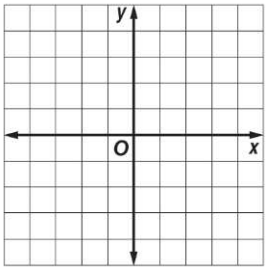
- Ahmad earns a monthly salary of AED 1200 and a commission of AED 125 for each car he sells.

  a. Graph an equation that represents how much Ahmad earns in a month in which he sells x cars.
  b. Use the graph to estimate the number of cars Ahmad needs to sell in order to earn AED 5000.

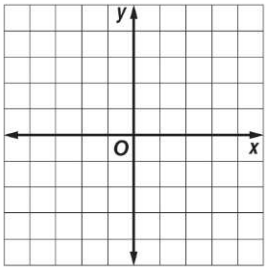
Lesson 2: Solving Linear equations by graphing.

A) Solve each linear function by graphing. Verify your answer algebraically.

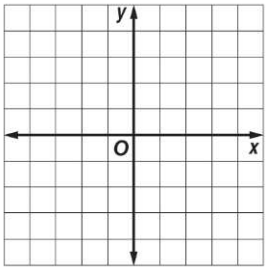
1. $0 = 2x + 3$



2. $0 = -5x + 3$



3. $5 = -x + 3$



B) Solve each equation by graphing. Verify your answer algebraically.

1. $5 - 8x = 16 - 8x$

2. $5x - 5 = 5x + 2$

3. $-7 = 4x + 1$

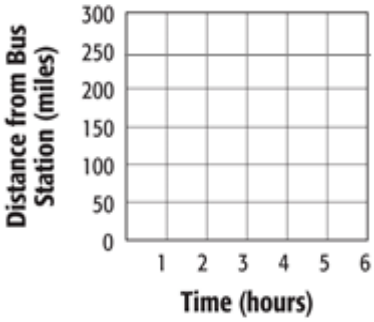
4. $-7x + 35 = 20 - 7x$

5. $0 = \frac{3}{4} - \frac{2}{5}x$

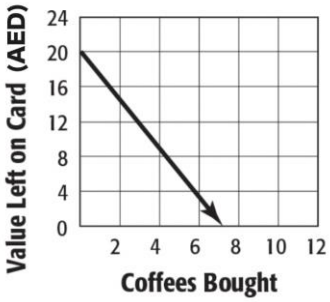
6. $0 = \frac{1}{2} - \frac{2}{3}x$

Problem Solving

- A bus is driving at 60 miles per hour toward a bus station that is 250 miles away. The function $d = 250 - 60t$ represents the distance d from the bus station the bus is t hours after it has started driving. Find the zero of this function. Describe what this value means in this context.



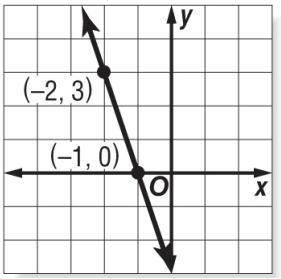
- Enrique uses a gift card to buy coffee at a coffee shop. The initial value of the gift card is AED 20. The function $n = 20 - 2.75c$ represents the amount of money still left on the gift card n after c cups of coffee are bought. Find the zero of this function. Describe what this value means in this context.



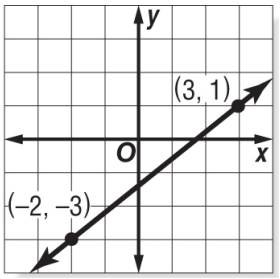
Lesson 3: Rate of change and slope

A) Find the slope of the line that passes through each pair of points.

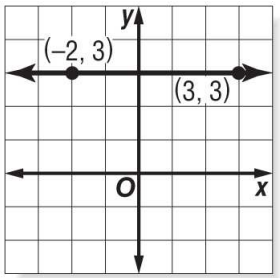
1.



2.



3.



4. (6, 3), (7, –4)
5. (–9, –3), (–7, –5)
6. (6, –2), (5, –4)
7. (7, –4), (4, 8)

B) Determine whether each function is linear. Explain

x	*y*
–3	11
–2	15
–1	19
1	23
2	27

x	*y*
12	–4
9	1
6	6
3	11
0	16

x	*y*
–0.2	0.7
0	0.4
0.2	0.1
0.4	0.3
0.6	0.6

C) Find the value of *r* so the line that passes through each pair of points has the given slope.

1. (–2, *r*), (6, 7), $m = \frac{1}{2}$
2. (–4, 3), (*r*, 5), $m = \frac{1}{4}$
3. (–3, –4), (–5, *r*), $m = -\frac{9}{2}$
4. (–5, *r*), (1, 3), $m = \frac{7}{6}$

Problem Solving

- The table shows the population density for the state of Texas in various years. Find the average annual rate of change in the population density from 2000 to 2009.

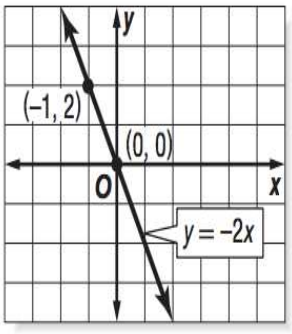
Population Density	
Year	**People Per Square Mile**
1930	22.1
1960	36.4
1980	54.3
2000	79.6
2009	96.7

- A daily newspaper had 12,125 subscribers when it began publication. Five years later it had 10,100 subscribers. What is the average yearly rate of change in the number of subscribers for the five-year period?

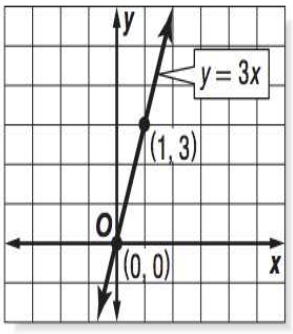
Lesson 4: Direct Variation

A) **Name the constant of variation for each equation. Then determine the slope of the line that passes through each pair of points.**

1.



2.



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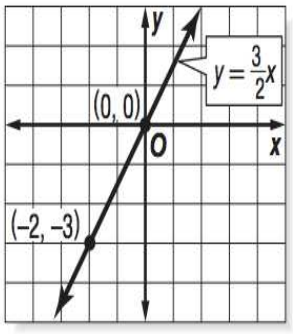
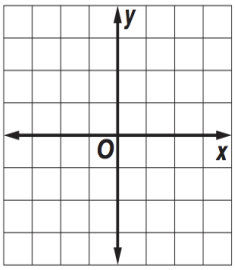
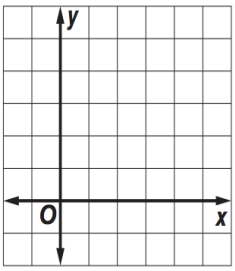


B) Graph each equation:

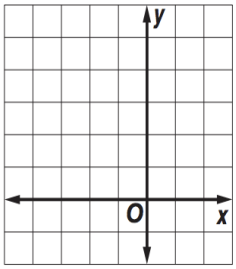
4. $y = -2x$



5. $y = \frac{6}{5}x$



6. $y = -\frac{5}{2}x$



C) Suppose *y* varies directly as *x*. Write a direct variation equation that relates *x* and *y*. Then solve.

1. If $y = 7.5$ when $x = 0.5$, find y when $x = -0.3$.

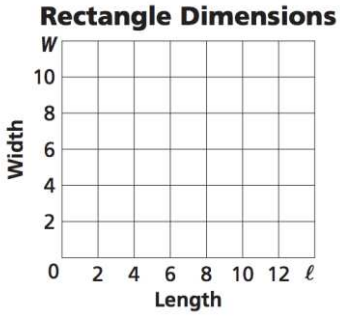
2. If $y = 80$ when $x = 32$, find x when $y = 100$.

3. If $y = \frac{3}{4}$ when $x = 24$, find y when $x = 12$.

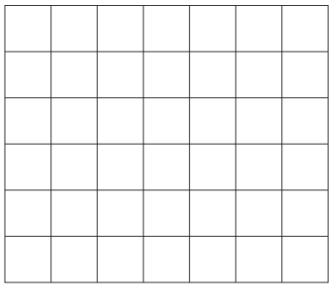
4. If $y = 4\frac{1}{4}$ when $x = \frac{3}{4}$ find y when $x = 4\frac{1}{2}$

D) Write a direct variation equation that relates the variables. Then graph the equation.

- The width *w* of a rectangle is two thirds of the length.

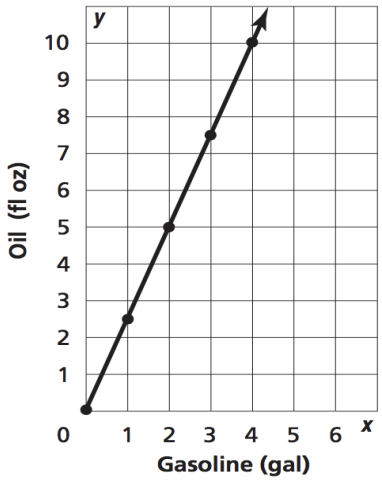


- The total cost ***c*** of tickets is. AED 4.50 times the number of tickets ***t***.



Problem Solving

- The engine of a chainsaw requires a mixture of engine oil and gasoline. According to the directions, oil and gasoline should be mixed as shown in the graph below. What is the constant of variation for the line graphed?



- At top speed, a rabbit can cover 7 miles in 12 minutes. If a rabbit could continue at this rate indefinitely, how long would it take the rabbit to cross the 220-mile expanse of the Mojave Desert? (The rabbit's distance varies directly with his time.)

- A dishwasher uses 65 gallons of water to wash 5 loads of dishes. The number of gallons it uses is directly proportional to the number of loads the dishwasher can clean. How many gallons of water would be used to wash 12 loads?

- Depreciation is the decline in a car's value over the course of time. The table below shows the values of a car with an average depreciation.

Age of Car (Years)	**1**	**2**	**3**	**4**	**5**
Value (AED)	12,000	10,200	8,400	6,600	4,800

a. Write an equation that relates the age x of the car to the value y that it lost after each year.

b. Find the age of the car if the value is AED 300.

Lesson 5: Arithmetic Sequences as Linear Functions

A) Determine whether each sequence is an arithmetic sequence. Write *yes* or *no*. Explain.

1. 21, 13, 5, –3, ...

2. –5, 12, 29, 46, ...

3. –2.2, –1.1, 0.1, 1.3, ...

4. 1, 4, 9, 16, ...

5. 9, 16, 23, 30, ...

6. –1.2, 0.6, 1.8, 3.0, ...

B) Find the next three terms of each arithmetic sequence.

7. 82, 76, 70, 64, ...

8. –49, –35, –21, –7, ...

9. $\frac{3}{4}, \frac{1}{2}, \frac{1}{4}$, 0, ...

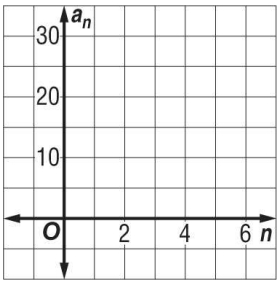
10. –10, –3, 4, 11 ...

11. 12, 10, 8, 6, ...

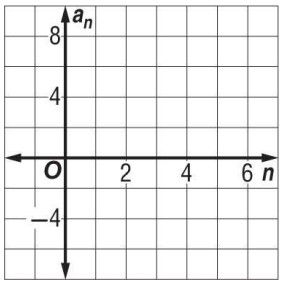
12. 12, 7, 2, –3, ...

C) Write an equation for the *n*th term of each arithmetic sequence. Then graph the first five terms of the sequence.

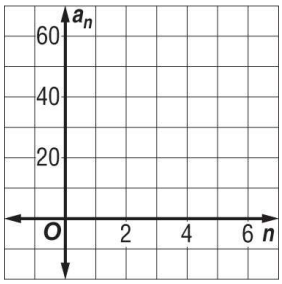
13. 9, 13, 17, 21, ...



14. –5, –2, 1, 4, ...



15. 19, 31, 43, 55, ...



Problem Solving

- Jassem deposited AED 115.00 into a new savings account. Each week thereafter, he deposits another AED 35.00.

  a. Write a function to represent the balance of Jassem's savings account for any number of weeks after his initial deposit if he makes no withdrawals.

  b. What is the balance of Jassem's savings account 30 weeks after his initial deposit?

- Jack is stacking boxes of tissue for a store display. Each row of tissues has 2 fewer boxes than the row below. The first row has 23 boxes of tissues.

  a. Write a function to represent the arithmetic sequence.

  b. How many boxes will there be in the tenth row?

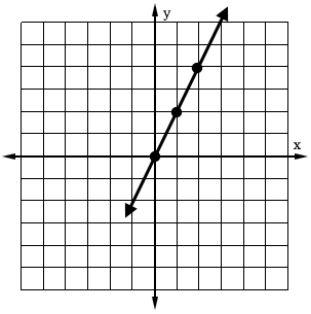
Lesson 6: Proportional and Nonproportional Relationships:

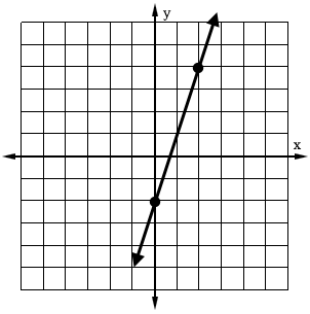
A) The table shows the pages of books read.

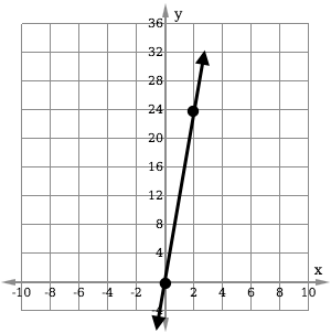
Books Read	1	2	3	4	5
Pages Read	35	70	105	140	175

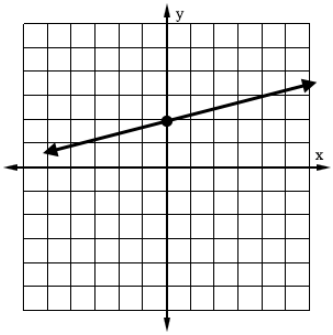
a. Graph the data.
b. Write an equation to describe the relationship.
c. Find the number of pages read if 10 books were read.

B) Write an equation in function notation for each relation.









Problem Solving

- A School wants to sell T-shirts in the bookstore for the spring show. The cost in dirhams to order T-shirts in their school colors is represented by the equation $C = 2t + 3$.

  a. Make a table of values that represents this relationship.

  b. Rewrite the equation in function notation.

  c. Graph the function.

  d. Describe the relationship between the number of T-shirts and the cost.

Chapter 4: Equations and linear functions

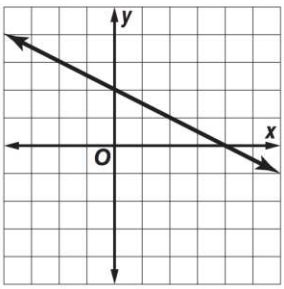
Lesson 1: Graphing equations in slope-intercept from.

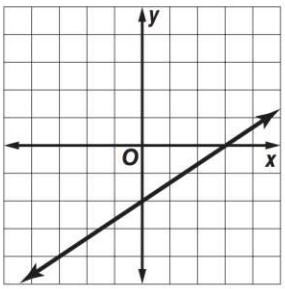
A) Write an equation of a line in slope-intercept form with the given slope and y-intercept.

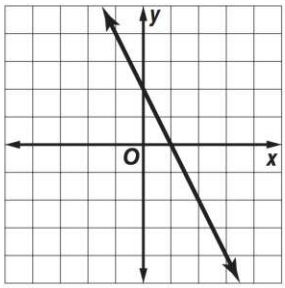
1. slope 5, *y*-intercept: –3 **2.** slope –2, *y*-intercept: 7 **3.** slope –6, *y*-intercept: –2

4. slope $\frac{2}{3}$, *y*-intercept: –5 **5.** slope $-\frac{5}{6}$, *y*-intercept: 5 **6. .** slope $-\frac{3}{7}$, *y*-intercept: 2

B) Write an equation in slope-intercept form for each graph shown.







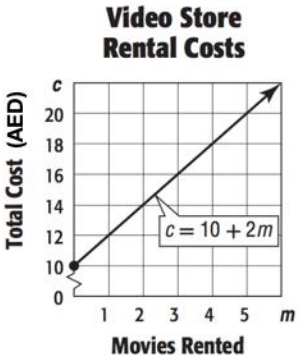
C) Graph each equation.

1. $y = x + 4$ **2.** $y = -2x - 1$ **3.** $y + x = -3$ **4.** $12 = 6y$

Problem Solving

A video store charges AED 30 for a rental card plus AED 6 per rental.

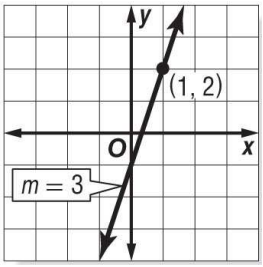
a) Write an equation in slope-intercept form for the total cost *c* of buying a rental card and renting *m* movies.
b) Graph the equation
c) Find the cost of buying a rental card and renting 6 movies.



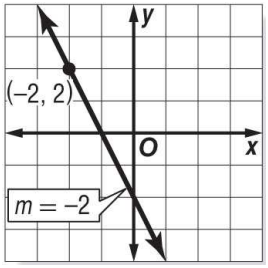
Lesson 2: Writing Equations in Slope-Intercept Form

A) Write an equation of the line that passes through the given point and has the given slope.

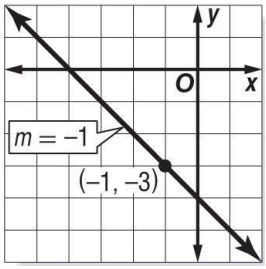
1.



2.



3.



4. (–5, 4); slope –3

5. (4, 3); slope $\frac{1}{2}$

6. (1, –5); slope $-\frac{3}{2}$

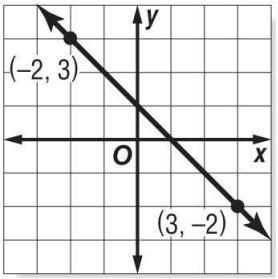
7. (3, 7); slope $\frac{2}{7}$

8. $\left(-2,\ \frac{5}{2}\right)$; slope $-\frac{1}{2}$

9. (5, 0); slope 0

B) Write an equation of the line that passes through each pair of points.

1.



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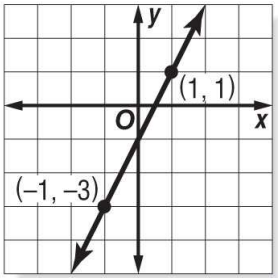

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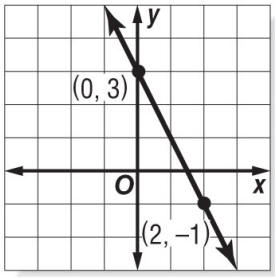

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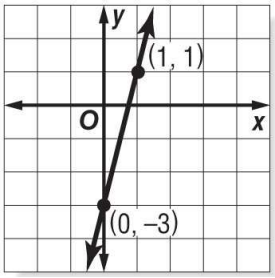
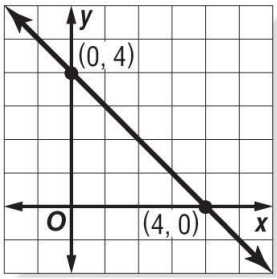


6.



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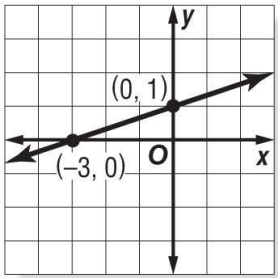


8. (1, 3), (–3, –5)

9. (1, 4), (6, –1)

10. (1, –1), (3, 5)

11. (–2, 4), (0, 6)

12. (3, 3), (1, –3)

13. (–1, 6), (3, –2)

Problem Solving

- The cost for 7 candies is AED 82. The cost for 11 candies is AED 122. Write a linear equation to find the total cost C for ℓ candies. Then use the equation to find the cost of 4 candies.

- It is 76°F at the 6000-foot level of a mountain, and 49°F at the 12,000-foot level of the mountain. Write a linear equation to find the temperature T at an elevation x on the mountain, where x is in thousands of feet.

- The price of a share of stock in XYZ Corporation was AED 74 two weeks ago. Seven weeks ago, the price was AED 59 a share.

  a. Write a linear equation to find the price p of a share of XYZ Corporation stock w weeks from now.
  b. Estimate the price of a share of stock five weeks ago.

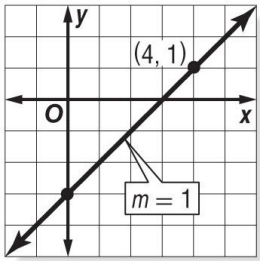
- Mr. Kamel receives AED 3,000 annual salary increase on the anniversary of his hiring if he receives a satisfactory performance review. His starting salary was AED 41,250. Write an equation to show k, Mr. Kamel's salary after t years at this company if his performance reviews are always satisfactory.

- Mr. Jassem pays AED 150 a month for city water, no matter how many gallons of water he uses in a given month. Let x represent the number of gallons of water used per month. Let y represent the monthly cost of the city water in dollars. What is the equation of the line that represents this information? What is the slope of the line?

Lesson 3: Writing Equations in Point-Slope Form

A) Write an equation in point-slope form for the line that passes through each point with the given slope.

1.



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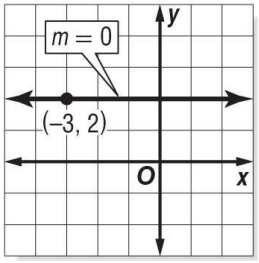

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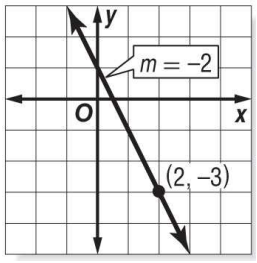


4. (2, 1), $m = 4$

5. (–7, 2), $m = 6$

6. (8, 3), $m = 1$

7. (–6, 7), $m = 0$

8. (4, 9), $m = \frac{3}{4}$

9. (–4, –5), $m = -\frac{1}{2}$

10. Write an equation in point-slope form for a horizontal line that passes through (4, –2).

B) Write each equation in standard form.

1. $y + 2 = -3(x - 1)$

2. $y - 1 = -\frac{1}{3}(x - 6)$

3. $y + 2 = \frac{2}{3}(x - 9)$

4. $y + 3 = -(x - 5)$

5. $y - 4 = \frac{5}{3}(x + 3)$

6. $y + 4 = -\frac{2}{5}(x - 1)$

C) **Write each equation in slope-intercept form.**

1. $y + 4 = 4(x - 2)$

2. $y - 5 = \frac{1}{3}(x - 6)$

3. $y - 8 = -\frac{1}{4}(x + 8)$

4. $y - 6 = 3\left(x - \frac{1}{3}\right)$

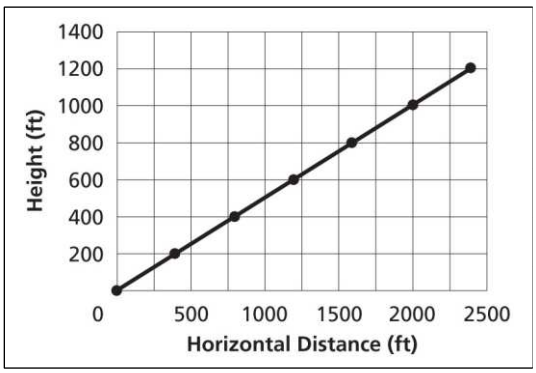
5. $y + 4 = -2(x + 5)$

6. $y + \frac{5}{3} = \frac{1}{2}(x - 2)$

Problem Solving

- Kamel rides his bike at an average speed of 12 miles per hour. In other words, he rides 12 miles in 1 hour, 24 miles in 2 hours, and so on. Let h be the number of hours he rides and d be distance traveled. Write an equation for the relationship between distance and time in point-slope form.

- A jet plane takes off and consistently climbs 20 feet for every 40 feet it moves horizontally. The graph shows the trajectory of the jet.



a. Write an equation in point-slope form for the line representing the jet's trajectory.

b. Write the equation from part **a** in slope -intercept form.

c. Write the equation in standard form.

Lesson 4: Parallel and Perpendicular Lines

A) Write an equation in slope-intercept form for the line that passes through the given point and is parallel to the graph of the given equation.

1. (3, 2), $y = x + 5$ **2.** (–2, 5), $y = -4x + 2$ **3.** (4, –6), $y = -\frac{3}{4}x + 1$

4. (–1, –4), $9x + 3y = 8$ **5.** (–5, 6), $4x + 3y = 1$ **6.** (3, 1), $2x + 5y = 7$

B) Write an equation in slope-intercept form for the line that passes through the given point and is perpendicular to the graph of the given equation.

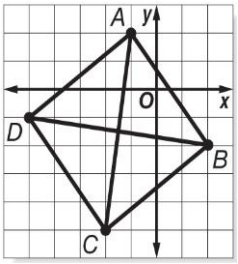
1. (–2, –2), $y = -\frac{1}{3}x + 9$ **2.** (–6, 5), $x - y = 5$ **3.** (–4, –3), $4x + y = 7$

4. (1, 1), $3x + 2y = -7$ **5.** (–6, –5), $4x + 3y = -6$ **6.** (–3, 5), $5x - 6y = 9$

C) Determine whether the graphs of any of the following equations are *parallel* or *perpendicular*. Explain.

1. $y = \frac{2}{3}x + 3$, $y = \frac{3}{2}x$, $2x - 3y = 8$ **2.** $y = 4x$, $x + 4y = 12$, $4x + y = 1$

Problem Solving



- Quadrilateral *ABCD* has diagonals $\overline{AC}$ and $\overline{BD}$. Determine whether $\overline{AC}$ is perpendicular to $\overline{BD}$. Explain.

- Triangle *ABC* has vertices *A*(0, 4), *B*(1, 2), and *C*(4, 6). Determine whether triangle *ABC* is a right triangle. Explain.

- A parallelogram is created by the intersections of the lines $x = 2$, $x = 6$, $y = \frac{1}{2}x + 2$, and another line. Find the equation of the fourth line needed to complete the parallelogram. The line should pass through (2, 0). (*Hint:* Sketch a graph to help you see the lines.)

- An archaeologist is comparing the location of a jeweled box she just found to the location of a brick wall. The wall can be represented by the equation $y = -\frac{5}{3}x + 13$. The box is located at the point (10, 9). Write an equation representing a line that is perpendicular to the wall and that passes through the location of the box.

Lesson 6: Inverse Linear Functions:

A) Find the inverse of each relation.

1.

x	y
–9	–1
–7	–4
–5	–7
–3	–10
–1	–13

2.

x	y
1	8
2	6
3	4
4	2
5	0

3.

x	y
–4	–2
–2	–1
0	1
2	0
4	2

4. {(–3, 2), (–1, 8), (1, 14), (3, 20)}

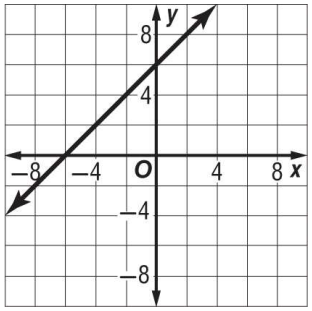
5. {(5, –3), (2, –9), (–1, –15), (–4, –21)}

6. {(4, 6), (3, 1), (2, –4), (1, –9)}

7. {(–1, 16), (–2, 12), (–3, 8), (–4, 4)}

B) Graph the inverse of each function.

1.



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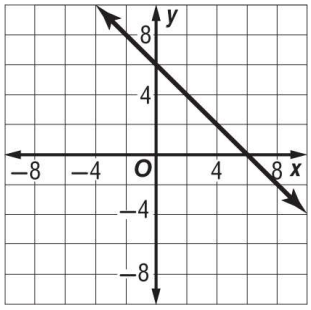

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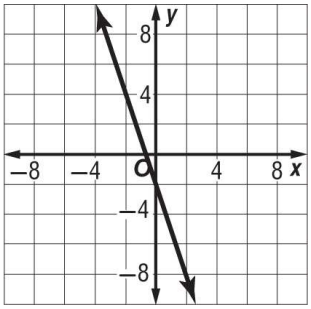

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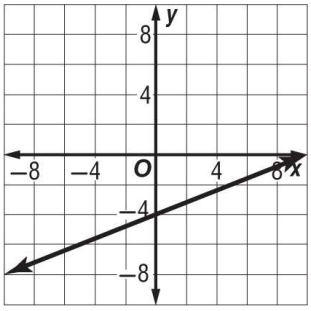

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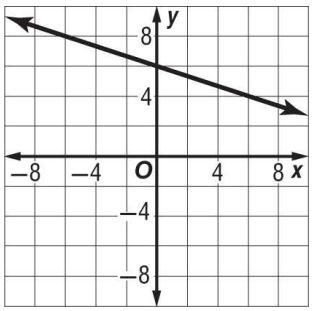
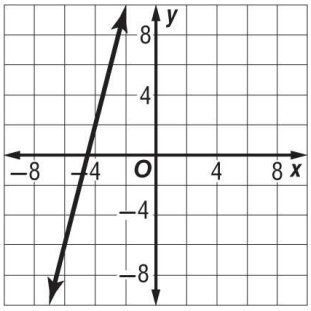


6.



C) Find the inverse of each function.

1. $f(x) = 8x - 5$

2. $f(x) = 6(x + 7)$

3. $f(x) = \frac{3}{4}x + 9$

4. $f(x) = -16 + \frac{2}{5}x$

5. $f(x) = \frac{3x + 5}{4}$

6. $f(x) = \frac{-4x + 1}{5}$

8. $f(x) = \frac{6}{5}x - 3$

9. $f(x) = \frac{4x + 2}{3}$

10. $f(x) = \frac{3x - 1}{6}$

11. $f(x) = 3(3x + 4)$

12. $f(x) = -5(-x - 6)$

13. $f(x) = \frac{2x - 3}{7}$

14. $f(x) = \frac{6}{5}x - 3$

15. $f(x) = \frac{4x + 2}{3}$

16. $f(x) = \frac{3x - 1}{6}$

17. $f(x) = 3(3x + 4)$

18. $f(x) = -5(-x - 6)$

19. $f(x) = \frac{2x - 3}{7}$

D) Write the inverse of each equation in $f^{-1}(x)$ notation.

1. $4x + 6y = 24$

2. $-3y + 5x = 18$

3. $x + 5y = 12$

4. $5x + 8y = 40$

5. $-4y - 3x = 15 + 2y$

6. $2x - 3 = 4x + 5y$

Problem Solving

- Jamal is running in a charity event. One donor is paying an initial amount of AED 2,000 plus an extra AED 500 for every mile that Jamal runs.

  a. Write a function $D(x)$ for the total donation for x miles run.

  b. Find the inverse function, $D^{-1}(x)$.

  c. What do x and $D^{-1}(x)$ represent in the context of the inverse function?

- Salma spent AED 15.00 on supplies and lemonade powder for her lemonade stand. She charges AED 1.50 per glass.

  a. Write a function $P(x)$ to represent her profit per glass sold.

  b. Find the inverse function, $P^{-1}(x)$.

  c. What do x and $P^{-1}(x)$ represent in the context of the inverse function?

  d. How many glasses must Salma sell in order to make an AED 9 profit?

- The area of the base of a cylindrical water tank is 66 square feet. The volume of water in the tank is dependent on the height of the water h and is represented by the function $V(h) = 66h$. Find $V^{-1}(h)$. What will the height of the water be when the volume reaches 2310 cubic feet?

- Layla's family went bowling during a holiday special. The special cost AED 40 for pizza, bowling shoes, and unlimited drinks. Each game cost AED 2. How many games did Libby bowl if the total cost was AED 112 and the six family members bowled an equal number of games?

- A technician is working on a furnace. He is paid AED 150 per visit plus AED 70 for every hour he works on the furnace.

  a. Write a function $C(x)$ to represent the total charge for every hour of work.

  b. Find the inverse function, $C^{-1}(x)$

  c. How long did the technician work on the furnace if the total charge was AED 640?

- Karma is having baseboard installed in her basement. The total cost $C(x)$ in dollars is given by $C(x) = 125 + 16x$, where x is the number of pieces of wood required for the installation.

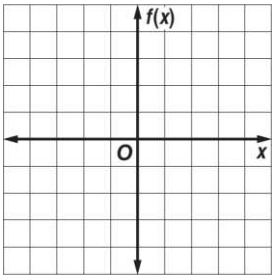
  a. Find the inverse function $C^{-1}(x)$.

  b. If the total cost was AED 269 and each piece of wood was 12 feet long, how many total feet of wood were used?

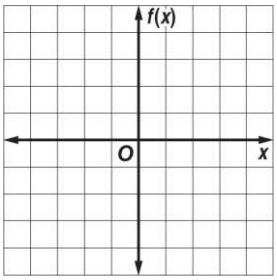
***Lesson 7: Special Linear Functions*:**

A) Graph each function. State the domain and range.

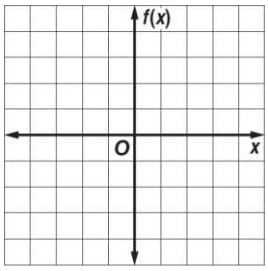
1. $f(x) = [\![x - 2]\!]$



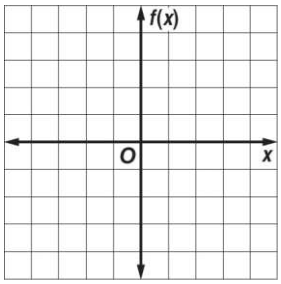
2. $f(x) = 3[\![x]\!]$



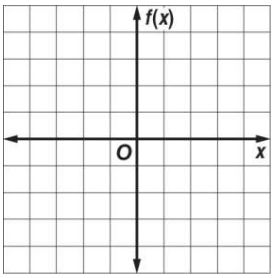
3. $f(x) = [\![2x]\!]$



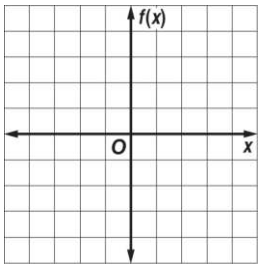
4. $f(x) = \begin{cases} x - 3 & \text{if } x > 1 \\ -x + 3 & \text{if } x \leq 1 \end{cases}$



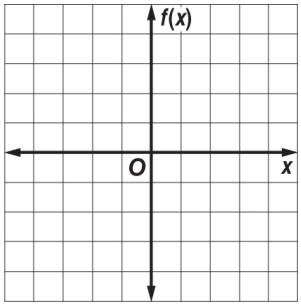
5. $f(x) = \begin{cases} x - 1 & \text{if } x > -1 \\ -x + 2 & \text{if } x < -1 \end{cases}$



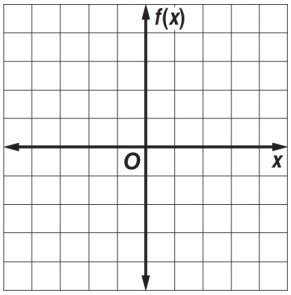
6. $f(x) = \begin{cases} -x - 2 & \text{if } x > 0 \\ -x & \text{if } x \leq 0 \end{cases}$



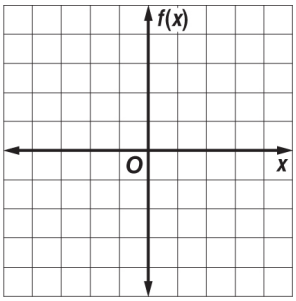
7. $f(x) = \begin{cases} 2x & \text{if } x \leq 1 \\ -x + 3 & \text{if } x > 2 \end{cases}$



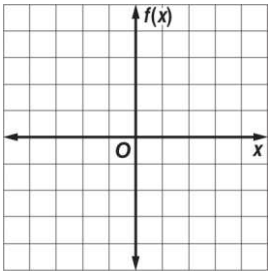
8. $f(x) = \begin{cases} x + 4 & \text{if } x \leq 1 \\ \frac{1}{3}x + 1 & \text{if } x > 1 \end{cases}$



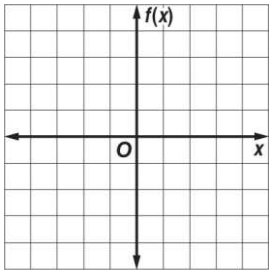
9. $f(x) = \begin{cases} x + 2 & \text{if } x < 0 \\ -0.5x + 1 & \text{if } x \geq 0 \end{cases}$



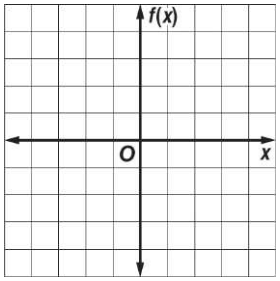
10. $f(x) = \begin{cases} 2x - 1 & \text{if } x \geq -2 \\ -1 & \text{if } x < -2 \end{cases} - 3$



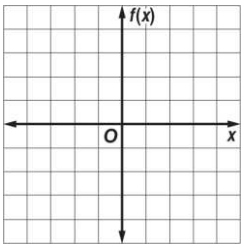
11. $f(x) = \begin{cases} 2 & \text{if } x > -1 \\ x + 4 & \text{if } x \leq -1 \end{cases}$



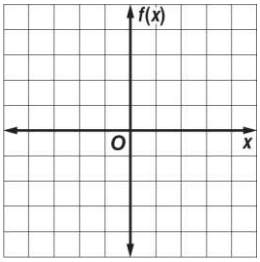
12. $f(x) = \begin{cases} -2x + 3 & \text{if } x > 0 \\ \frac{1}{2}x - 1 & \text{if } x \leq 0 \end{cases}$



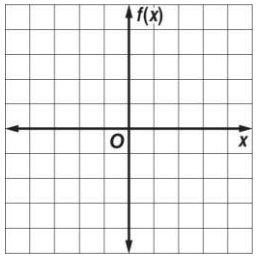
13. $f(x) = |x| - 1$



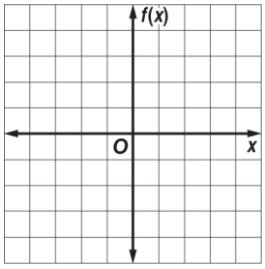
14. $f(x) = |x + 1| - 2$



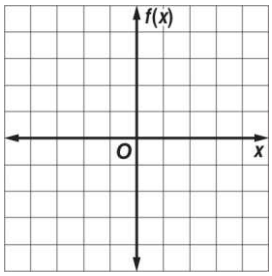
15. $f(x) = -\left|\frac{1}{2}x\right| + 1$



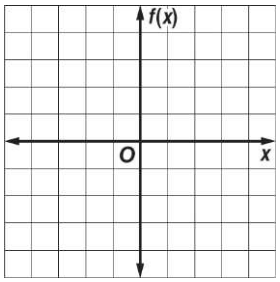
16. $f(x) = |2x + 4| - 3$



17. $f(x) = -|x - 2| + 4$

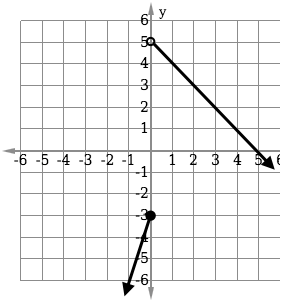


18. $f(x) = -|2x + 2| + 3$



B) Determine the domain and range of each function.

1.



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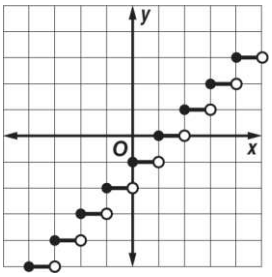

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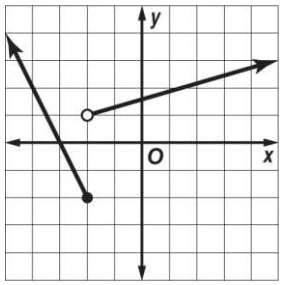
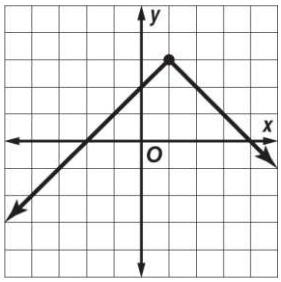


4.



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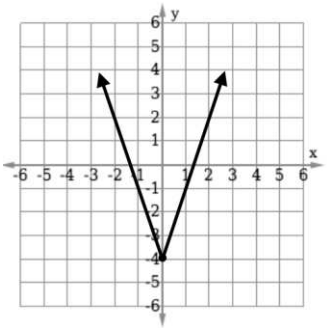

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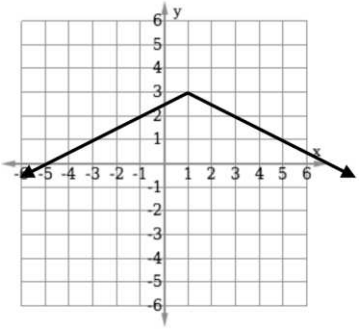
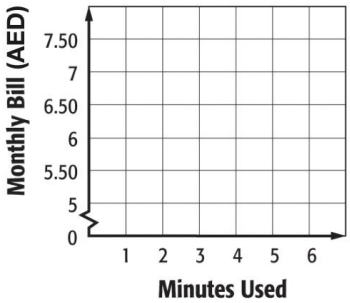


Problem Solving

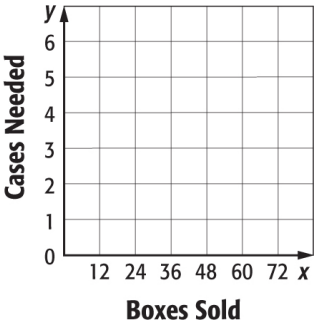
- Gad's cell phone service costs AED 5 each month plus AED 0.35 for each minute he uses. Every fraction of a minute is rounded up to the next minute.

  a. Draw a graph to represent the cost of using the cell phone.

  b. What is Gad's monthly bill if he uses 124.8 minutes?



- Students are selling boxes of cookies at a fund-raiser. The boxes of cookies can only be ordered by the case, with 12 boxes per case. Draw a graph to represent the number of cases needed *y* when *x* boxes of cookies are sold.



- A parking meter at a parking garage charges AED 4 per hour. Every fraction of an hour is rounded up to the next hour. What is the cost for parking a car in the parking garage for $3\frac{1}{2}$ hours?

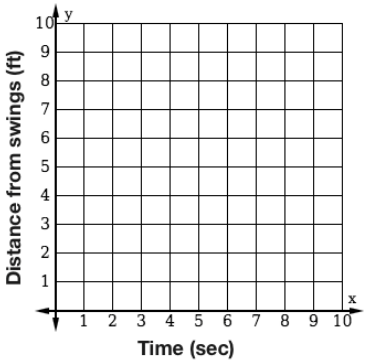
- A manufacturing company produces boxes of cereal, *b*. A small box of cereal must have 12 ounces. If the amount of cereal in a small box differs from the desired 12 ounces by more than *x*, the box cannot be shipped for selling. Write an equation that can be used to find the highest and lowest amounts of cereal in a small box.

- A package delivery service determines rates for express shipping by the weight of a package, with every fraction of a pound rounded up to the next pound. The table shows the cost of express shipping packages that weigh no more than 5 pounds. Write a piecewise-linear function representing the cost to ship a package that weighs no more than 5 pounds. State the domain and range.

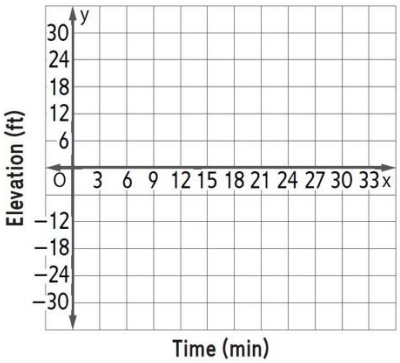
Weight (pounds)	Rate (dollars)
1	16.20
2	19.30
3	22.40
4	25.50
5	28.60

- The function $y = \frac{5}{4}|x - 5|$ models Rashad's distance in feet from the swings on a playground after *x* seconds.

  a. Graph the function.
  b. After how many seconds will Rashad reach the swings?



- The function $y = 3|x - 12| - 36$ models a scuba diver's elevation in feet compared to sea level after *x* minutes. Graph the function. How far below sea level is the scuba diver at the deepest point in their dive?



Chapter 5: linear functions inequalities

Lesson 3: Solving Multi-Step Inequalities

A) Solve each inequality. Graph the solution on a number line.

1. $-2b + 4 > -6$

2. $3x + 15 \leq 21$

3. $\frac{d}{2} - 1 \geq 3$

4. $2(-3m - 5) \geq -28$

5. $-6(w + 1) < 2(w + 5)$

6. $2(q - 3) + 6 \leq -1$

7. $-5 - \frac{t}{6} \geq -9$

8. $4u - 6 \geq 6u - 20$

9. $13 > \frac{2}{3}a - 1$

10. $\frac{w + 3}{2} < -8$

11. $\frac{3f - 10}{5} > 7$

12. $h \leq \frac{6h + 3}{5}$

B) Define a variable, write an inequality, and solve each problem. Check your solution.

1. Four more than the quotient of a number and three is at least nine.
2. The sum of a number and fourteen is less than or equal to three times the number.
3. Negative three times a number increased by seven is less than negative eleven.
4. Five times a number decreased by eight is at most ten more than twice the number.
5. Seven more than five sixths of a number is more than negative three.
6. Four times the sum of a number and two increased by three is at least twenty-seven.
7. A number is less than one fourth the sum of three times the number and four.
8. Two times the sum of a number and four is no more than three times the sum of the number and seven decreased by four.

Problem Solving

- The area of a triangular garden can be no more than 120 square feet. The base of the triangle is 16 feet. What is the height of the triangle?

- Nabuko practices the violin at least 12 hours per week. She practices for three fourths of an hour each session. If Nabuko has already practiced 3 hours in one week, how many sessions remain to meet or exceed her weekly practice goal?

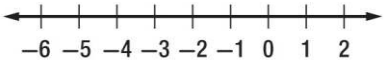
- The perimeter of a rectangular playground must be no greater than 120 meters, because that is the total length of the materials available for the border. The width of the playground cannot exceed 22 meters. What are the possible lengths of the playground?

- Jay has lost his mother's favorite necklace, so he will rent a metal detector to try to find it. A rental company charges a one-time rental fee of AED 150 plus AED 20 per hour to rent a metal detector. Jay has only AED 350 to spend. What is the maximum amount of time he can rent the metal detector?

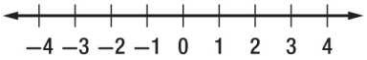
Lesson 4: Solving Compound Inequalities

A) Graph the solution set of each compound inequality.

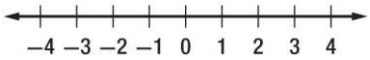
1. $-4 \le n \le 1$



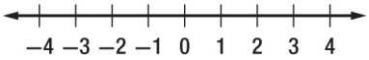
2. $x > 0$ or $x < 3$



3. $g < -3$ or $g \ge 4$

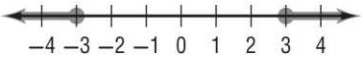


4. $-4 \le p \le 4$



B) Write a compound inequality for each graph.

1.



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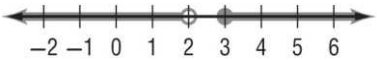

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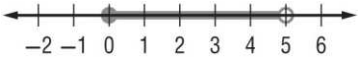

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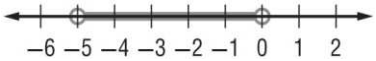

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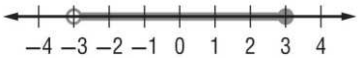

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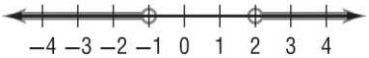

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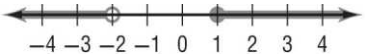

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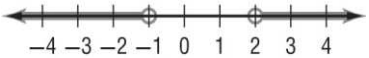
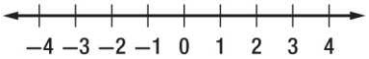
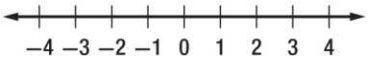


C) Solve each compound inequality. Then graph the solution set.

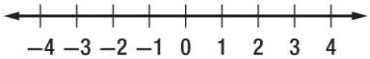
1. $k - 3 < -7$ or $k + 5 \ge 8$



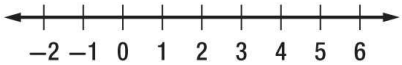
2. $-n < 2$ or $2n - 3 > 5$



3. $5 < 3h + 2 \le 11$



4. $2c - 4 > -6$ and $3c + 1 < 13$



D) Define a variable, write an inequality, and solve each problem. Check your solution.

1. A number plus one is greater than negative five and less than three.

2. A number decreased by two is at most four or at least nine.

3. The sum of a number and three is no more than eight or is more than twelve.

4. Two times a number plus one is greater than five and less than seven.

5. A number minus one is at most nine, or two times the number is at least twenty-four.

Problem Solving

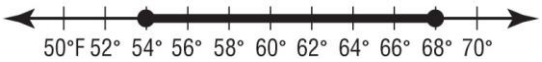
- Strong winds called the prevailing westerlies blow from west to east in a belt from 40° to 60° latitude in both the Northern and Southern Hemispheres.

  a. Write an inequality to represent the latitude of the prevailing westerlies in the Northern Hemisphere.
  b. Write an inequality to represent the latitudes where the Northern prevailing westerlies are *not* located.

- A cookie contains 9 grams of fat. If you eat no fewer than 4 and no more than 7 cookies, how many grams of fat will you consume?

- The human heart circulates from 770,000 to 1,600,000 gallons of blood through a person's body every year. How many gallons of blood does the heart circulate through the body in one day?

- Ken saw this graph in the newspaper weather forecast. It shows the predicted temperature range for the following day. Write an inequality to represent the number line graph.



- The pH of a person's eyes is 7.2. Therefore, the ideal pH for the water in a swimming pool is between 7.0 and 7.6. Write a compound inequality to represent pH levels that could cause physical discomfort to a person's eyes.

Lesson 5: Inequalities Involving Absolute Value

A) Match each open sentence with the graph of its solution set.

1. $|x| > 2$

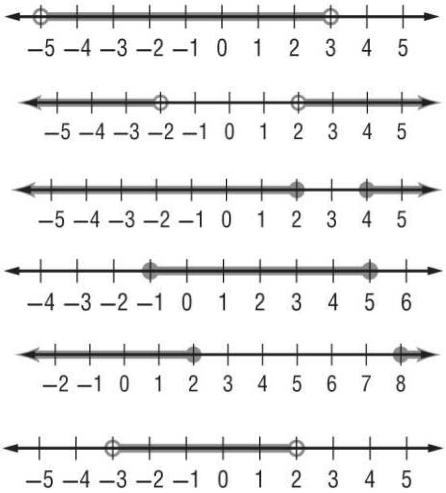
2. $|x - 2| \leq 3$

3. $|x + 1| < 4$

4. $|x - 3| \geq 1$

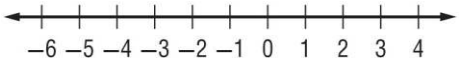
5. $|2x + 1| < 5$

6. $|5 - x| \geq 3$

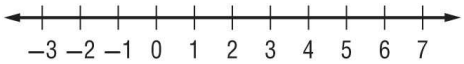


B) Solve each inequality. Then graph the solution set.

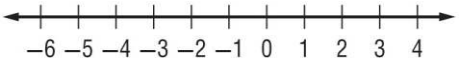
1. $|x + 1| < 0$



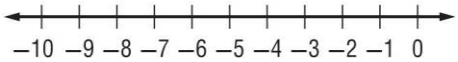
2. $|c - 3| < 1$



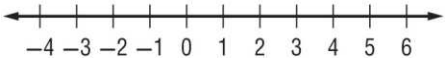
3. $|n + 2| \geq 1$



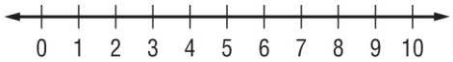
4. $|t + 6| > 4$



5. $|w - 2| < 2$



6. $|k - 5| \leq 4$



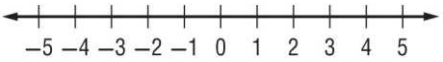
C) Express each statement using an inequality involving absolute value.

1. The height of the plant must be within 2 inches of the standard 13-inch show size.

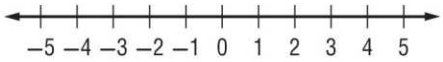
2. The majority of grades in Sean's English class are within 4 points of 85.

D) Solve each inequality. Then graph the solution set.

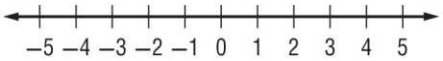
1. $|2z - 9| \leq 1$



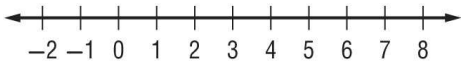
2. $|3 - 2r| > 7$



3. $|3t + 6| < 9$



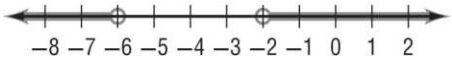
4. $|2g - 5| \geq 9$



E) Write an open sentence involving absolute value for each graph.

1.

2.



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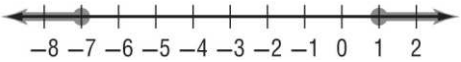


4.

Problem Solving

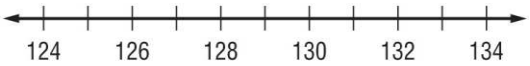
- The menu at Khaled's favorite restaurant states that the roasted chicken with vegetables entree typically contains 480 Calories. Based on the size of the chicken, the actual number of Calories in the entree can vary by as many as 40 Calories from this amount.

  a. Write an absolute value inequality to represent the situation.
  b. What is the range of the number of Calories in the chicken entree?

- The government requires speedometers on cars sold in a country to be accurate within ±2.5% of the actual speed of the car. If your speedometer reads 60 miles per hour while you are driving on a highway, what is the range of possible actual speeds at which your car could be traveling?

- In an Olympic archery event, the center of the target is set exactly 130 centimeters off the ground. To get the highest score of ten points, an archer must shoot an arrow no further than 3.05 centimeters from the exact center of the target.

  a. Write an absolute value inequality to represent the possible distances d from the ground an archer can hit the target and still score ten points.
  b. Graph the solution set of the inequality you wrote in part **a**.



Lesson 6: Graphing Inequalities in Two Variables

A) Determine which ordered pairs are part of the solution set for each inequality.

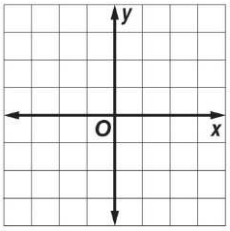
1. $3x + y \geq 6$, {(4, 3), (–2, 4), (–5, –3), (3, –3)}

2. $y \geq x + 3$, {(6, 3), (–3, 2), (3, –2), (4, 3)}

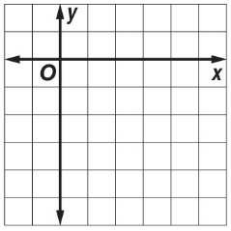
3. $3x - 2y < 5$, {(4, –4), (3, 5), (5, 2), (–3, 4)}

B) Graph each inequality.

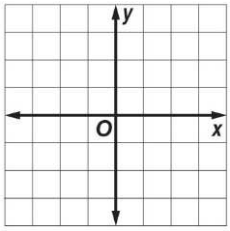
1. $y < -1$



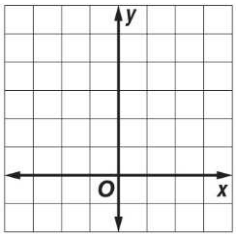
2. $y \geq x - 5$



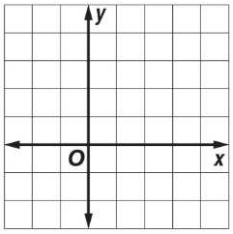
3. $y > 3x$



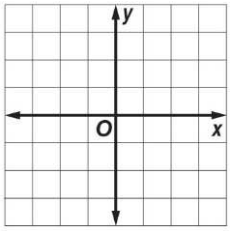
4. $y \leq 2x + 4$



5. $y + x > 3$

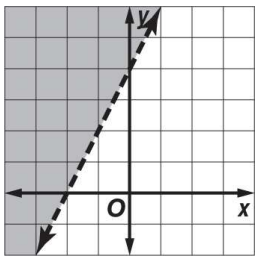


6 $y - x \geq 1$



C) Write an inequality to represent each graph.

1.



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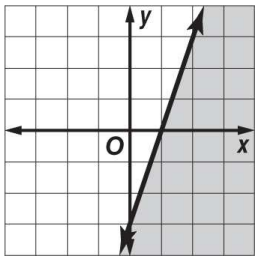

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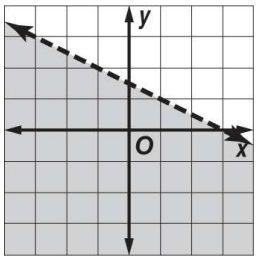


Problem Solving

- Saeed found a used bookstore that sells pre-owned DVDs and books. DVDs cost AED 27 each, and books cost AED 21 each. Saeed can spend no more than AED 105.

  a. Write an inequality that represents this situation.
  b. Does Saeed have enough money to buy 2 DVDs and 3 books?

- A moving van has an interior height of 7 feet (84 inches). You have boxes in 12 inch and 15-inch heights, and want to stack them as high as possible to fit. Write an inequality that represents this situation.

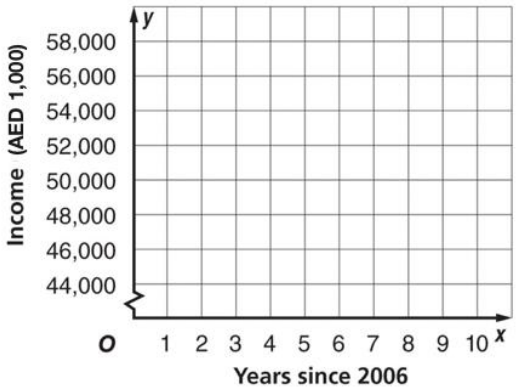
- In 2006 the median yearly family income was about AED 48,200 per year. Suppose the average annual rate of change since then is AED1240 per year.

  a. Write and graph an inequality for the annual family incomes y that are less than the median for x years after 2006.

  b. Determine whether each of the following points is part of the solution set.

  1. (2, 51,000) **2.** (8, 69,200)

  3. (5, 50,000) **4.** (10, 61,000)



- The average value of a farm cropland has steadily increased in recent years. In 2000, the average value was AED 14,900 per acre. Since then, the value has increased at least an average of AED 700 per acre per year. Write an inequality to show land values above the average for farmland.

- Fatima is decorating her bedroom. She has AED 300 to spend on paint and bed linens. A liter of paint costs AED 14, while a set of bed linens costs AED 60

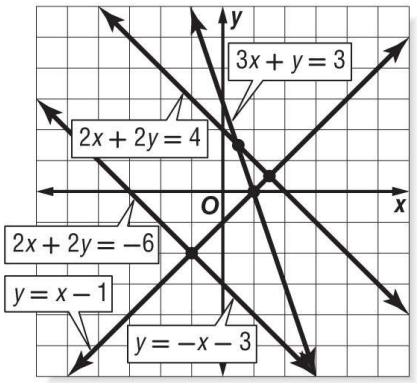
  a. Write an inequality for this situation.

  b. How many milliliters of paint and bed linen sets can Fatima buy and stay within her budget?

Chapter 6: Systems of linear equations and inequalities

Lesson 1: Graphing Systems of Equations

A) Use the graph at the right to determine whether each system is *consistent* or *inconsistent* and if it is *independent* or *dependent*.



1. $y = -x - 3$
$y = x - 1$

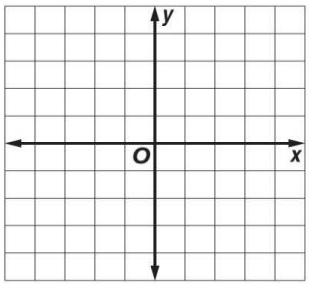
2. $2x + 2y = -6$
$y = -x - 3$

3. $y = -x - 3$
$2x + 2y = 4$

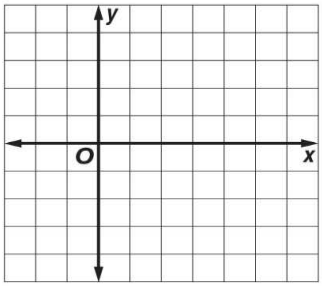
4. $2x + 2y = -6$
$3x + y = 3$

B) Graph each system and determine the number of solutions that it has. If it has one solution, name it.

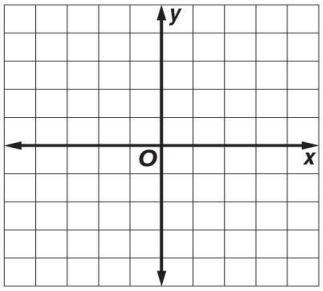
1. $2x - y = 1$
$y = -3$



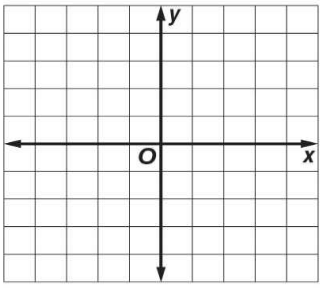
2. $x = 1$
$2x + y = 4$



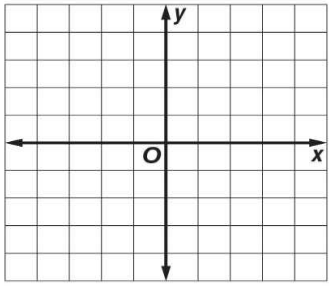
3. $3x + y = -3$
$3x + y = 3$



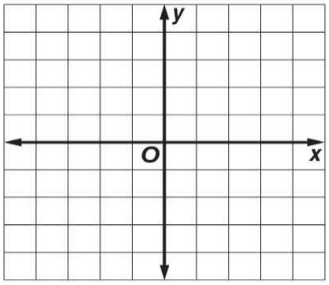
4. $y = x + 2$
$x - y = -2$



5. $x + 3y = -3$
$x - 3y = -3$

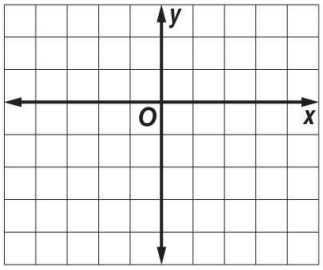


6. $y - x = -1$
$x + y = 3$



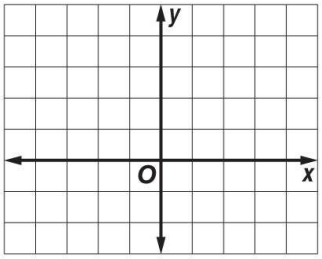
7. $x - y = 3$

$x - 2y = 3$



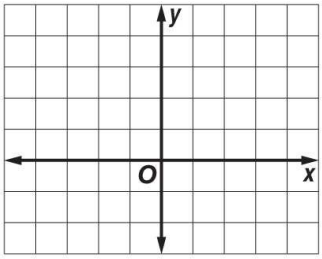
8. $x + 2y = 4$

$y = -\frac{1}{2}x + 2$



9. $y = 2x + 3$

$3y = 6x - 6$



Problem Solving

- Majed plans to start a home-based business producing and selling gourmet dog treats. He figures it will cost AED 20 in operating costs per week plus AED 0.50 t0 produce each treat. He plans to sell each treat for AED 1.50.

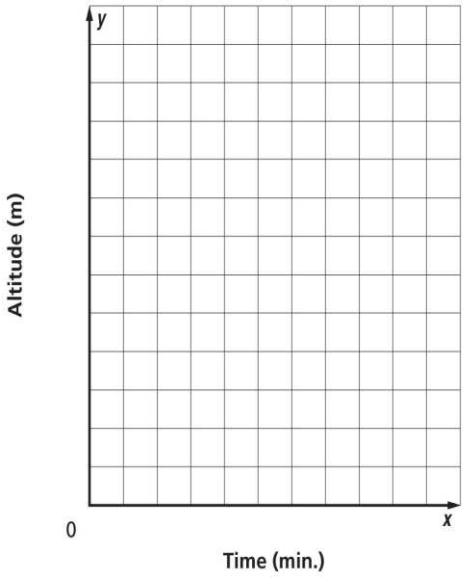
a. Graph the system of equations $y = 0.5x + 20$ and $y = 1.5x$, where x is the number of treats sold per week.

b. How many treats does Majed need to sell per week to break even?

- Two planes are in flight near a local airport. One plane is at an altitude of 1000 meters and is ascending at a rate of 400 meters per minute. The second plane is at an altitude of 5900 meters and is descending at a rate of 300 meters per minute.

a. Write a system of equations that represents the altitude of each plane

b. Make a graph that represents the altitude of each plane.



Lesson 2: Substitution

Use substitution to solve each system of equations.

1. $y = 4x$
$x + y = 5$

2. $y = 2x$
$x + 3y = -14$

3. $y = 3x$
$2x + y = 15$

4. $x = -4y$
$3x + 2y = 20$

5. $2x + 5y = 38$
$x - 3y = -3$

6. $x - 4y = 27$
$3x + y = -23$

7. $2x + 2y = 7$
$x - 2y = -1$

8. $2.5x + y = -2$
$3x + 2y = 0$

9. $0.5x + 4y = -1$
$x + 2.5y = 3.5$

10. $3x - 2y = 11$
$x - \frac{1}{2}y = 4$

11. $\frac{1}{3}x - y = 3$
$2x + y = 25$

12. $\frac{1}{2}x + 2y = 12$
$x - 2y = 6$

Problem Solving

- The measures of complementary angles have a sum of 90 degrees. Angle *A* and angle *B* are complementary, and their measures have a difference of 20°. What are the measures of the angles?

- Mr. Rasheed finds that the supply and demand for gasoline at his station are generally given by the following equations.

$$x - y = -2$$
$$x + y = 10$$

  Use substitution to find the equilibrium point where the supply and demand lines intersect.

- Khalid is buying tickets online for a concert. He finds tickets for himself and his friends for AED 65 each plus a one-time fee of AED 10. Ahmed is looking for tickets to the same concert. he finds them at another Web site for AED 69 and a one-time fee of AED 13.60.

  a. Define the variables, and write equations to represent this situation.

  b. Create a table of values for 1 to 5 tickets for each person's purchase.

  c. Graph each of these equations.

  d. Use the graph to determine who received the better deal. Explain why.

- The perimeter of a triangle is 24 inches. The longest side is 4 inches longer than the shortest side, and the shortest side is three-fourths the length of the middle side. Find the length of each side of the triangle.

Lesson 3: Elimination Using Addition and Subtraction.

A) Use elimination to solve each system of equations.

1. $x - y = 1$
$x + y = 3$

2. $-x + y = 1$
$x + y = 11$

3. $x + 4y = 11$
$x - 6y = 11$

4. $-x + 3y = 6$
$x + 3y = 18$

5. $3x + 4y = 19$
$3x + 6y = 33$

6. $x + 4y = -8$
$x - 4y = -8$

7. $3x + 4y = 2$
$4x - 4y = 12$

8. $3x - y = -1$
$-3x - y = 5$

9. $2x - 3y = 9$
$-5x - 3y = 30$

10. $x - y = 4$
$2x + y = -4$

11. $7x + 2y = 2$
$7x - 2y = -30$

12. $4.25x - 1.28y = -9.2$
$x + 1.28y = 17.6$

13. $-\frac{1}{3}x - \frac{4}{3} = -2$
$\frac{1}{3}x - \frac{2}{3}y = 4$

14. $\frac{3}{4}x - \frac{1}{2}y = 8$
$\frac{3}{2}x + \frac{1}{2}y = 19$

Problem Solving

- The sum of two numbers is 28 and their difference is 4. What are the numbers?

- Find the two numbers whose sum is 29 and whose difference is 15.

- The sum of two numbers is 24 and their difference is 2. What are the numbers?

- Find the two numbers whose sum is 54 and whose difference is 4.

- Two times a number added to another number is 25. Three times the first number minus the other number is 20. Find the numbers.

- The sum of two numbers is 41 and their difference is 5. What are the numbers?

- Four times one number added to another number is 36. Three times the first number minus the other number is 20. Find the numbers.

- English is spoken as the first or primary language in 78 more countries than Farsi is spoken as the first language. Together, English and Farsi are spoken as a first language in 130 countries. In how many countries is English spoken as the first language? In how many countries is Farsi spoken as the first language?

- The Texas State Legislature is comprised of state senators and state representatives. The sum of the number of senators and representatives is 181. There are 119 more representatives than senators. How many senators and how many representatives make up the Texas State Legislature?

Lesson 5: Elimination Using Multiplication

Use elimination to solve each system of equations.

1. $2x - y = -1$
$3x - 2y = 1$

2. $5x - 2y = -10$
$3x + 6y = 66$

3. $7x + 4y = -4$
$5x + 8y = 28$

4. $2x - 4y = -22$
$3x + 3y = 30$

5. $3x + 2y = -9$
$5x - 3y = 4$

6. $4x - 2y = 32$
$-3x - 5y = -11$

7. $3x + 4y = 27$
$5x - 3y = 16$

8. $0.5x + 0.5y = -2$
$x - 0.25y = 6$

9. $2x - \frac{3}{4}y = -7$
$x + \frac{1}{2}y = 0$

10. $6x - 3y = 21$
$2x + 2y = 22$

11. $3x + 2y = 11$
$2x + 6y = -2$

12. $-3x + 2y = -15$
$2x - 4y = 26$

Problem Solving

- Eight times a number plus five times another number is –13. The sum of the two numbers is 1. What are the numbers?

- The sum of the digits of a two-digit number is 11. If the digits are reversed, the new number is 45 more than the original number. Find the number.

- Gad invested AED10,000 in two mutual funds. One of the funds rose 6% in one year, and the other rose 9% in one year. If Gad's investment rose a total of $684 in one year, how much did he invest in each mutual fund?

- Salem and Bilal paddled a canoe 6 miles upstream in four hours. The return trip took three hours. Find the rate at which Salem and Bilal paddled the canoe in still water.

- Majed and Marwan are washing and vacuuming cars to raise money for a class trip. Majed raised AED 38 washing 5 cars and vacuuming 4 cars. Marwan raised AED 28 by washing 4 cars and vacuuming 2 cars. Find the amount they charged to wash a car and vacuum a car.

Lesson 5: Applying Systems of Linear Equations

Determine the best method to solve each system of equations. Then solve the system.

1. $1.5x - 1.9y = -29$
$x - 0.9y = 4.5$

2. $1.2x - 0.8y = -6$
$4.8x + 2.4y = 60$

3. $18x - 16y = -312$
$78x - 16y = 408$

4. $14x + 7y = 217$
$14x + 3y = 189$

5. $x = 3.6y + 0.7$
$2x + 0.2y = 38.4$

6. $5.3x - 4y = 43.5$
$x + 7y = 78$

Problem Solving

- A library contains 2000 books. There are 3 times as many non-fiction books as fiction books. Write and solve a system of equations to determine the number of nonfiction and fiction books.

- The chess club has 16 members and gains a new member every month. The film club has 4 members and gains 4 new members every month. Write and solve a system of equations to find when the number of members in both clubs will be equal.

- Tamer and Amjed each sold snack bars and magazine subscriptions for a school fund-raiser, as shown in the table. Tamer earned AED 132 and Amjed earned AED 190.

  a. Define variable and formulate a system of linear equation from this situation.

  b. What was the price per snack bar? Determine the reasonableness of your solution.

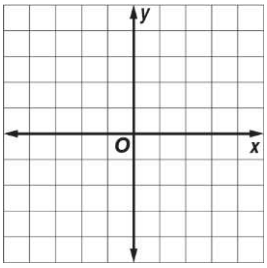
Item	Number Sold	
	Tamer	Amjed
snack bars	16	20
magazine subscriptions	4	6

- Aya makes 14 baskets during her game. Some of these baskets were worth 2 points and others were worth 3 points. In total, she scored 30 points. Write and solve a system of equations to find how many 2-point baskets she made.

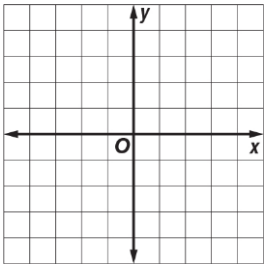
Lesson 6: Systems of Inequalities

A) Solve each system of inequalities by graphing.

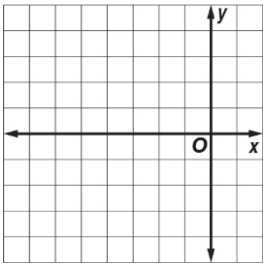
1. $x > -1$
$y \leq -3$



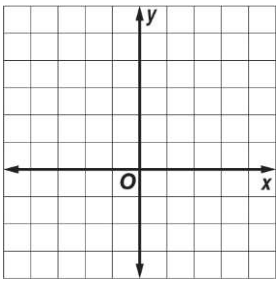
2. $y > 2$
$x < -2$



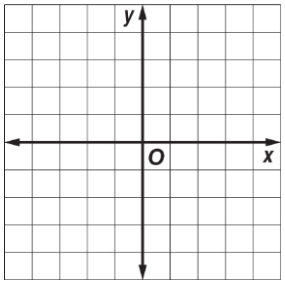
3. $y > x + 3$
$y \leq -1$



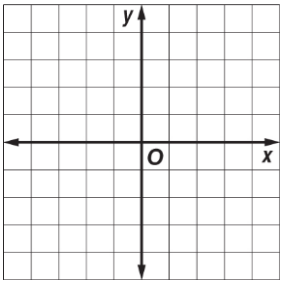
4. $x < 2$
$y - x \leq 2$



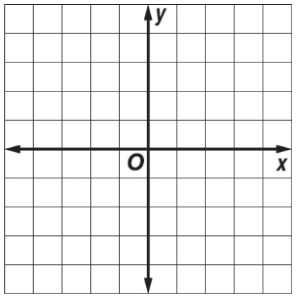
5. $x + y \leq -1$
$x + y \geq 3$



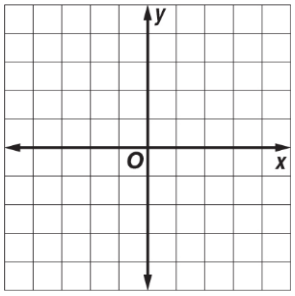
6. $y - x > 4$
$x + y > 2$



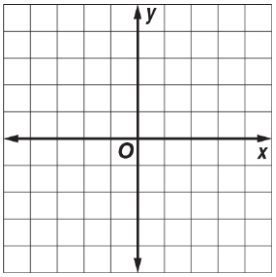
7. $y > x + 1$
$y \geq -x + 1$



8. $y \geq -x + 2$
$y < 2x - 2$

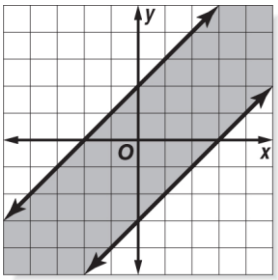


9. $y < 2x + 4$
$y \geq x + 1$



B) Write a system of inequalities for each graph.

1.



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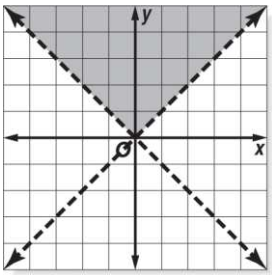

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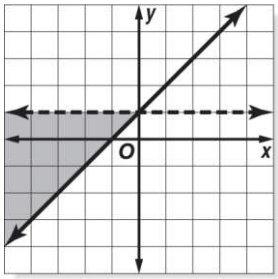


Problem Solving

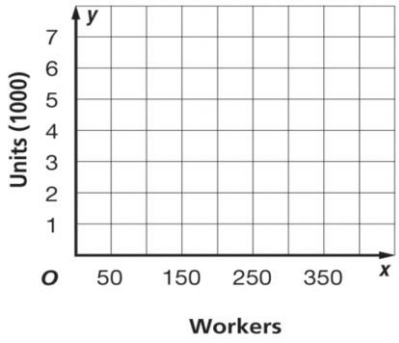
- For maximum efficiency, a factory must have at least 100 workers, but no more than 200 workers on a shift. The factory also must manufacture at least 30 units per worker.

  a. Let x be the number of workers and let y be the number of units. Write four inequalities expressing the conditions in the problem given above.
  b. Graph the systems of inequalities.
  c. List at least three possible solutions

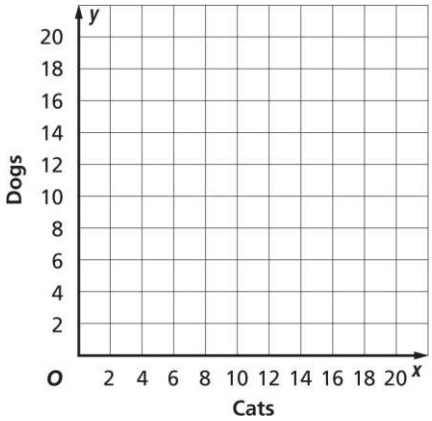
- Saleh started an exercise program in which each week he works out at the gym from 4.5 to 6 hours and walks from 9 to 12 miles.

  a. Make a graph to show the number of hours Saleh works out at the gym and the number of miles he walks per week.

  b. List three possible combinations of working out and walking that meet Saleh's goals.



- Salem's Pet Store never has more than a combined total of 20 cats and dogs and never more than 8 cats. This is represented by the inequalities $x \leq 8$ and $x + y \leq 20$. Solve the system of inequalities by graphing



Mock exam A

Grade 9 Advanced

Part I

Circle the letter corresponding to the correct answer.

1) Write a simplified expression to represent 4 times the sum of x and 5 increased by 10.

a) $4x + 30$

b) $4x + 25$

c) $20x + 10$

d) $60x$

2) Solve $2^3 - \text{b} > -6(2 - 4)$.

a) $b < -6$

b) $b < -4$

c) $b > -6$

d) $b > -4$

3) Evaluate $\frac{a^2-b}{-c}$ for a = −3, b = −1, and c = 2

a) −4

b) 4

c) 5

d) −5

4) Evaluate $|-2(5a + b)| - |a - b^2|$ for a = 1 and b = −2.

a) 3

b) −3

c) 1

d) −9

5) A number is divided by three. The result is added to one. This result is multiplied by two to give 8. What is the number?

a) 18

b) 45

c) 1

d) 9

6) Solve $|x + 5| = 13$.

a) 8

b) –18

c) no solution

d) 8, –18

7) Solve $\frac{1}{2} + x = -\frac{3}{4}$

a) $-\frac{1}{4}$

b) $-1\frac{1}{4}$

c) -1

d) 1

8) Solve $2x + 4(x - 8) = \frac{3}{5}(10x + 15)$.

a) 0

b) all real numbers

c) no solution

d) 9

9) Solve the proportion $\frac{x+3}{4} = \frac{x-2}{5}$.

a) 23

b) –23

c) 7

d) –7

10) Solve $\frac{2}{3}x - \frac{1}{2} \leq \frac{1}{3}x$.

a) $x \geq \frac{3}{2}$

b) $x \leq \frac{3}{2}$

c) $x \geq 1$

d) $x \leq -1$

11) Write an equation to describe the relationship between the number of games and the points scored.

Number of games, *x*	3	4	5	6
Points scored, *y*	24	32	40	48

a) $y = 24x$

b) $y = 3x$

c) $y = 8x$

d) $y = \frac{1}{8}x$

12)The number of students at a school decreased from 840 to 735 over a 5-year period. What was the percent of decrease?

a) 27.10%

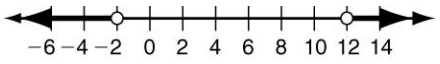
b) 12.5%

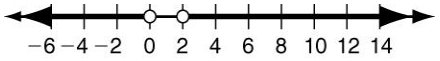
c) 21.0%

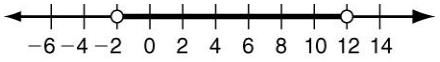
d) 14.29%

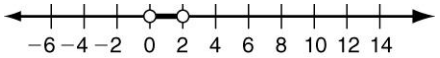
13) Which graph represents the solutions of

$x + 3 < 1$ OR $x - 6 > 6$?

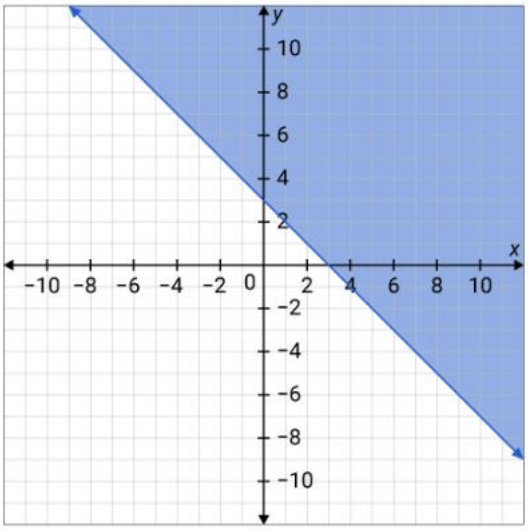
a) 

b) 

c) 

d) 

14) The solution of which linear inequality is graphed below?



a) $y \geq -x + 3$

b) $y > -x + 3$

c) $y < -x + 3$

d) $y \leq -x + 3$

15) Solve by substitution: $\begin{array}{c} 2x - y = 9 \\ x = 4y + 1 \end{array}$

a) (5, 1)

b) (1, 5)

c) (2, 7)

d) (7, 11)

16) Solve by elimination: $\begin{array}{c} 2x - 3y = 14 \\ 3x + 2y = 8 \end{array}$

a) (2, −4)

b) (4, −2)

c) $(-2, 4)$

d) $(4, -1)$

17) Which set of ordered pairs satisfies a linear function?

a)

x	1	1	1	1
y	4	6	8	10

b)

x	4	5	6	7
y	5	4	3	2

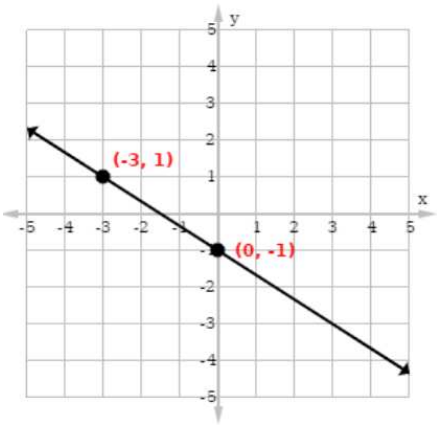
c)

x	1	2	3	4
y	5	7	10	12

d)

x	2	4	6	8
y	6	4	2	−3

18) Find the slope of this line.



a) $-\frac{2}{3}$

b) $\frac{2}{3}$

c) $-\frac{3}{2}$

d) $\frac{3}{2}$

19) Which equation describes the line with a slope of 2 and y-intercept of −5?

a) $y = -5x + 2$

b) $y = 2x - 5$

c) $y = 5x - 2$

d) $y = 2x + 5$

20) y varies directly with x, and $y = -8$ when $x = 4$. Find y when $x = 15$.

a) 30

b) 7.5

c) −7.5

d) −30

21) What is the common difference of the sequence 3, 2.5, 2, 1.5, …?

a) 0.5

b) 3

c) 2.5

d) −0.5

22) Which equation describes a line that passes through (−3, 6) and is parallel to the line described by $y = 3x - 4$?

a) $y = 3x + 15$

b) $y = -\frac{1}{3}x + 5$

c) $y = -3x - 3$

d) $y = \frac{1}{3}x + 7$

23) The common difference of an arithmetic sequence is −6. If a_{10} is 30, what is a_1 ?

a) 15

b) 30

c) 84

d) −84

24) Solve the following system for y:

$$2x + y = 8$$
$$2x - y = -2$$

a) $y = 5$

b) $y = -5$

c) $y = 2$

d) $y = -2$

25) If $f(x) = 7x + 5$, find $f^{-1}(x)$.

a) $f^{-1}(x) = 5x + 7$

b) $f^{-1}(x) = -7x - 5$

c) $f^{-1}(x) = \frac{x+5}{7}$

d) $f^{-1}(x) = \frac{x-5}{7}$

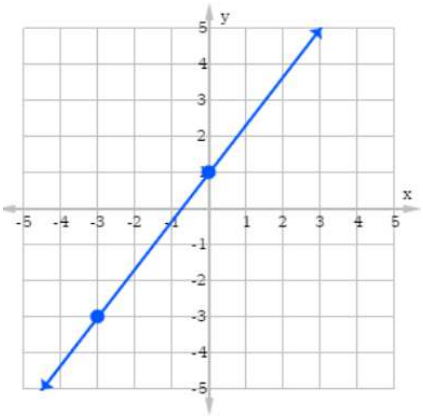
Part II

Show all the details when answering these questions.

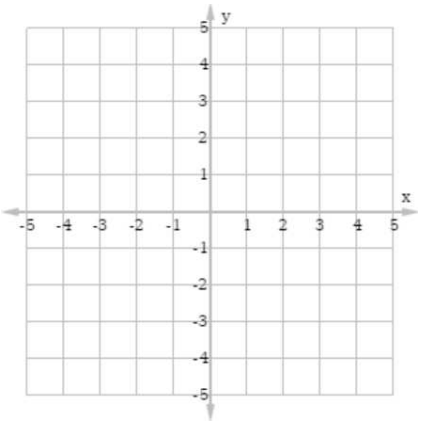
26) Write an equation for the nth term of the arithmetic sequence. Then graph the first five terms in the sequence.

−9, −14, −19, −24, …

27) Write an equation in function notation for the given relation.

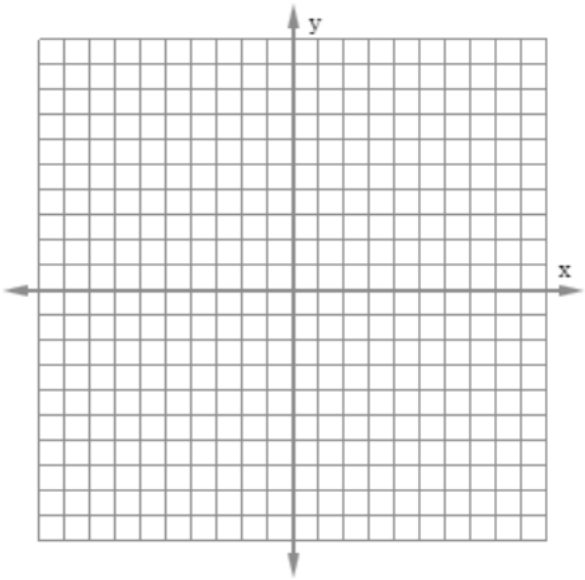


28) Solve $2x + 1 = -3$ by graphing.

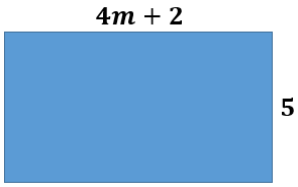


29) Fatima creates floral arrangements at her flower shop. She sells roses for AED 25 each and lilies for AED 45 each. She wants to create a floral arrangement that has 20 flowers made up of roses and lilies. She wants the average price for one of these flowers to be AED 38. How many of each flower should Fatima put in the vase?

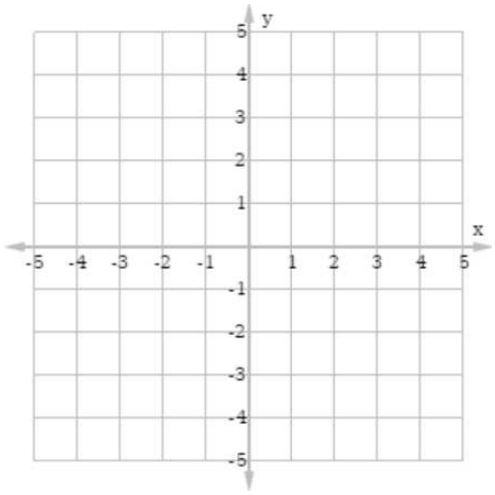
30) Use the x- and y- intercepts to graph $5x + 4y = 20$.



31) Write an algebraic expression to represent the area of the rectangle. Then evaluate it to find the area when $m = 7$ cm.

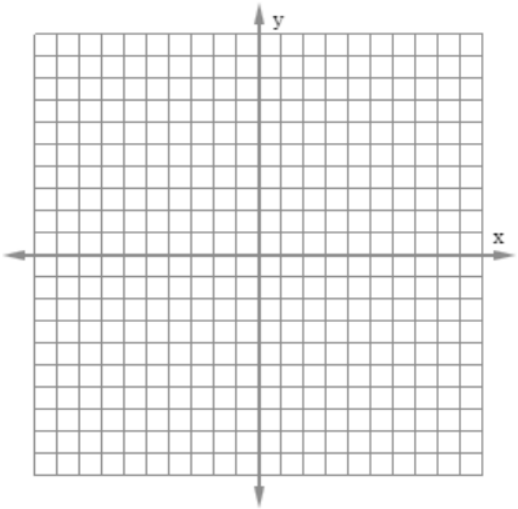


32) Solve $\begin{matrix} y > -2x + 1 \\ y \leq -2x - 2 \end{matrix}$ by graphing.



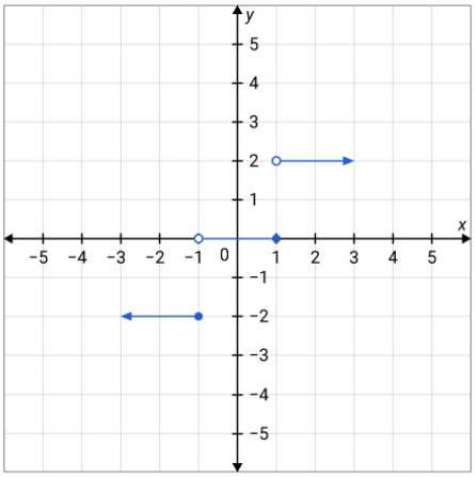
33) Determine the related function for the arithmetic sequence 5, 10, 15, ... Then determine if the function is proportional or nonproportional. Explain.

34) Graph $f(x) = |x| - 3$.



35) The graph of $f(x)$ is a line passing through (1, 4) and (2, 8) . What is the equation for its inverse function $f^{-1}(x)$?

36) Find the domain and the range of the function with the given graph.



Mock exam B

Grade 9 Advanced

Part I

Circle the letter corresponding to the correct answer.

1) Choose the correct verbal expression for the algebraic expression $3(a^2 - 9) + 5$.
   a) three times a squared minus nine plus five
   b) three times the quantity of a squared minus nine, plus five
   c) a squared minus nine times three, plus five
   d) 9 less than a squared minus nine plus five

2) Simplify $3(5a + b) - 4(a - 2b)$.
   a) $11a - 5b$
   b) $19a + 3b$
   c) $11a + 11b$
   d) $4a - 5b$

3) Evaluate $a(3 + b^2 - 2c)$ for a = 3, b = −2, and c = 5
   a) −33
   b) −9
   c) 27
   d) −27

4) Translate the following sentence into an equation.

   The product of six and a number x is two less than the quotient of three and x.
   a) $6 + x = \frac{3}{x} - 2$
   b) $6x = \frac{3}{x} - 2$
   c) $6x = 2 - \frac{3}{x}$
   d) $6 + x = 2 - \frac{3}{x}$

5) Solve $|x+8| = -13$.

a) 5

b) -21

c) no solution

d) 5, -21

6) Solve $4(3m + 2) = -3(m - 7)$.

a) $\frac{13}{15}$

b) $-1\frac{4}{15}$

c) $1\frac{14}{15}$

d) -13

7) Solve the proportion $\frac{7}{3x} = \frac{1}{12}$.

a) 4

b) 28

c) 56

d) 16

8) Solve the compound inequality

$-7 \leq m + 2 < 8$.

a) $10 \leq m < 16$

b) $6 \leq m < 39$

c) $-5 \leq m < 10$

d) $-9 \leq m < 6$

9) Solve $\frac{x}{21} - \frac{1}{3} = \frac{1}{21}$

a) -8

b) 6

c) -6

d) 8

10) The formula for the volume of a cone is $V = \frac{1}{3}\pi r^2 h$, where V represents the volume, r represents the radius of the base, and h represents the height. Solve for h.

a) $h = \frac{V}{3\pi r^2}$

b) $h = \frac{3V}{\pi r^2}$

c) $h = \frac{3\pi V}{r^2}$

d) $h = \frac{3Vr^2}{\pi}$

11) If 1 meter = 3.28 feet, use dimensional analysis to find 3.5 kilometers in miles. Round to the nearest hundredths. (*Hint*: 1 mi = 5280 ft)

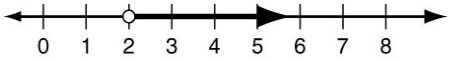
a) 1.51 mi

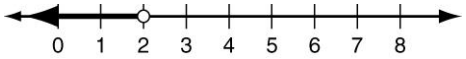
b) 2.17 mi

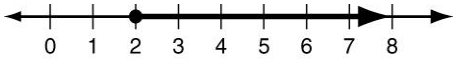
c) 5.63 mi

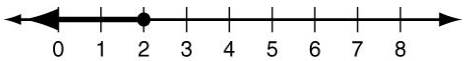
d) 11.48 mi

12) Which graph represents $x \geq 2$?

a) 

b) 

c) 

d) 

13) The original price of a bicycle is AED 450. What is the total cost of the bicycle after 5% tax?

a) AED 455

b) AED 445

c) AED 427.50

d) AED 472.50

14) Which represents the solution of $|x| - 8 > 10$?

a) $x > 18$ OR $x < -18$

b) $x < 18$ OR $x \geq -18$

c) $x > -18$ AND $x > 18$

d) $x > 18$ AND $x < -18$

15) Which ordered pair belongs to the inverse of the relation shown in the table?

x	1	4	7	9
y	8	3	−5	−6

a) (1, 8)

b) (4, 7)

c) (−6, 9)

d) (3, 1)

16) Which represents the solution of $6(x - 4) > 2(9 + 3x)$?

a) no solutions

b) $x < 18$

c) all real numbers

d) $x > -24$

17) Classify $\begin{array}{c} y = -2x - 2 \\ 4x + 2y = 12 \end{array}$

a) consistent and independent

b) consistent and dependent

c) inconsistent

d) inconsistent and dependent

18) Solve by substitution: $\begin{array}{c} y = 2x + 1 \\ 4x + 5y = 12 \end{array}$

a) (0.5, 2)

b) (2, 0.5)

c) (3, 7)

d) (7, 3)

19) Solve by elimination: $\begin{array}{c} 2x - 5y = -4 \\ x + 5y = 13 \end{array}$

a) (8, 4)

b) (3, 2)

c) $\left(\frac{5}{2}, \frac{9}{5}\right)$

d) $\left(4, \frac{9}{5}\right)$

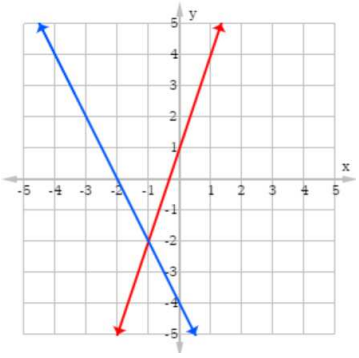
20) What is the solution of the system of linear equations with the given graph?

a) (−1, −2)

b) (−2, 0)

c) (0, −4)

d) (0, 1)



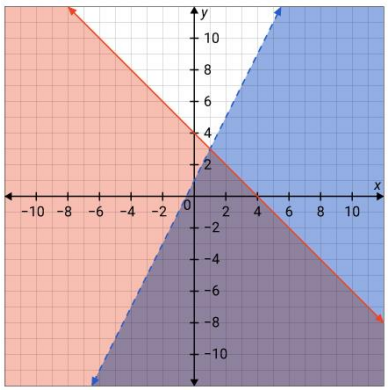
21) Which ordered pair is a solution of the system? (The purple area is the overlapping area)

a) $(-8, 4)$

b) $(0, 0)$

c) $(8, 0)$

d) $(0, 8)$



22) Find the value of p so that the line passes through $(-1, 2)$ and $(2, p)$ has a slope of $\frac{2}{3}$.

a) -4

b) 4

c) -2

d) 2

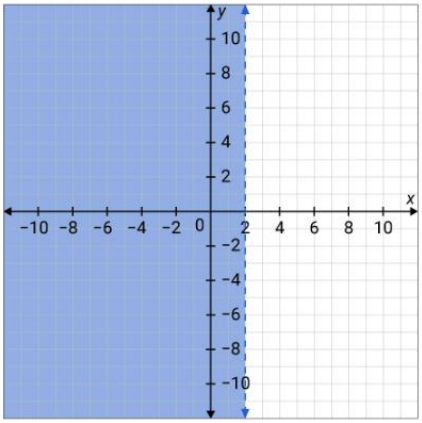
23) The solution of which linear inequality is graphed below?

a) $x \geq 2$

b) $x > 2$

c) $x < 2$

d) $x \leq 2$



24) What is the equation of the line passing through $(3, -4)$ with a slope of 0?

a) $x = 3$

b) $y = 3$

c) $x = -4$

d) $y = -4$

25) Which equation is NOT a direct variation?

a) $y = 10x$

b) $-3y = x$

c) $2x + y = 10$

d) $-5x + 7y = 0$

26) Which equation describes a line that passes through (−3, 6) and is perpendicular to the line described by $y = 3x - 4$?

a) $y = 3x + 15$

b) $y = -\frac{1}{3}x + 5$

c) $y = -3x - 3$

d) $y = \frac{1}{3}x + 7$

27) Find the next three terms in this sequence: 120, 70, 20, −30, …

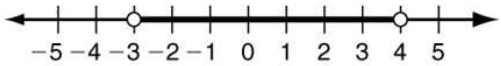
a) −70, −120, −170

b) −80, −130, −180

c) −60, −120, −170

d) −80, −130, −170

28) Which compound inequality is shown by the graph below?



a) $x > -3$ AND $x > 4$

b) $x > -3$ AND $x < 4$

c) $x > -3$ OR $x > 4$

d) $x > -3$ OR $x < 4$

29) What is the best estimate for the x-intercept of the graph of the linear function represented in the table?

a) between 3 and 5

b) between 5 and 7

c) between 7 and 9

d) between 9 and 11

x	y
3	-3
5	-1
7	1
9	3
11	5

30) If $f(x) = 5x - 7$, find $f^{-1}(x)$.

e) $f^{-1}(x) = 5x + 7$

f) $f^{-1}(x) = -5x - 7$

g) $f^{-1}(x) = \frac{x+7}{5}$

h) $f^{-1}(x) = \frac{x-7}{5}$

Part II

Show all the details when answering these questions.

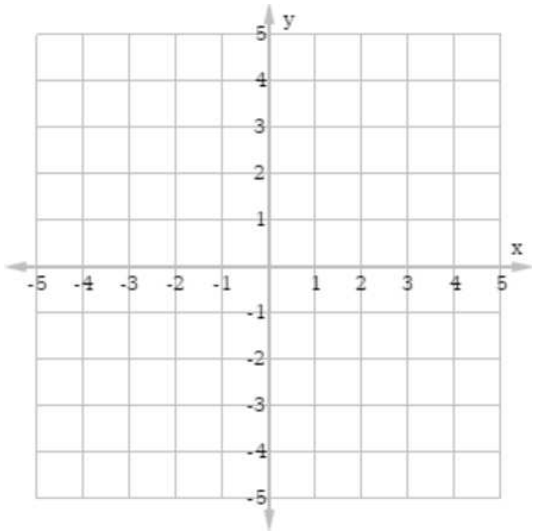
31) Tell whether $(-1, 8)$ is a solution of $y > 5 + 2x$.

32) A person walked 2.5 kilometers in 30 minutes and then jogged 1.5 more kilometers in 10 minutes. What was the average speed in kilometers per minute?

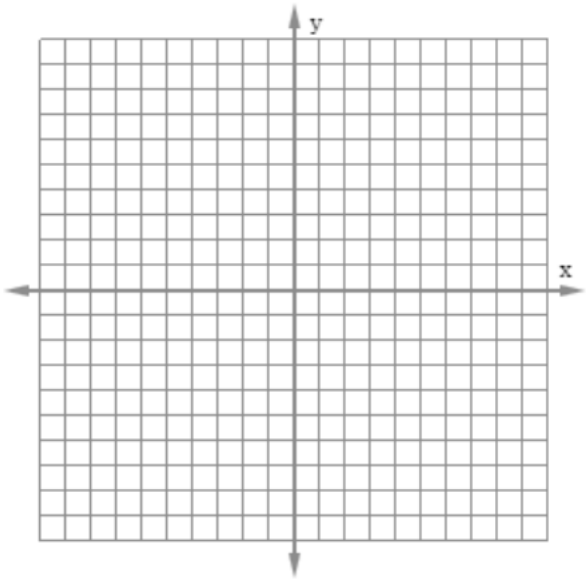
33) A teacher is choosing between two field trips. The first costs AED 1,200. The second costs AED 480 plus AED 40 per student. For what number of students is the first trip less expensive?

34) A chemist has a 2% acid solution and an 8% acid solution. He wants to mix the solutions to get 200 mL of a 5% acid solution. How many milliliters of each solutions does he need?

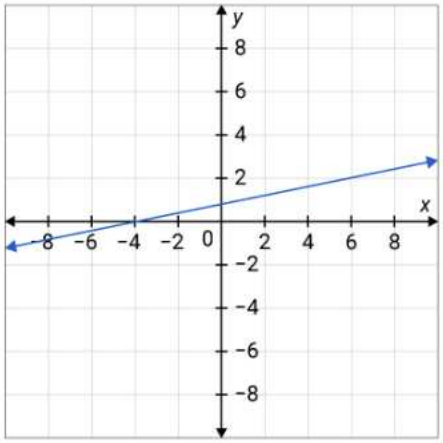
35) Solve $\begin{matrix} y = -x + 4 \\ y = 2x - 2 \end{matrix}$ by graphing.

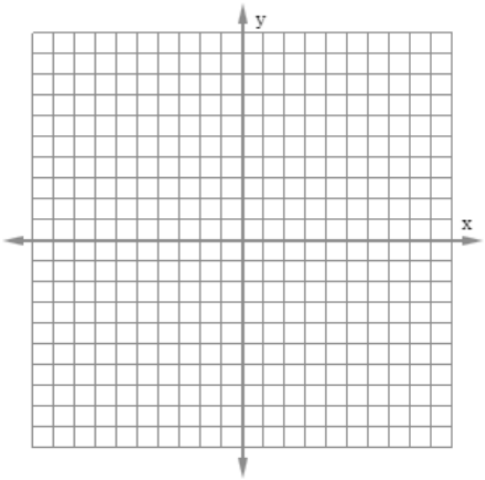


36) Graph $f(x) = |x - 3|$.



37) Graph the inverse of the function shown below.





38) Write the equation of the piecewise function with the given graph.