SREB Readiness Courses

Transitioning to college and careers

Math Ready

Unit 2 . Equations
Student Manual

Name

Unit 2 . Equations
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Task #1: New Shoes

You want to buy a new pair of shoes. While looking around at different shoes and styles online, you see a coupon for $10 off a pair of shoes at a local retailer in town. When you arrive at the store, you see they have sale, 15% off any pair of shoes in stock, but you are not allowed to apply any additional discounts. You do the math to decide whether the coupon or the 15% discount will save you the most money, and you find out the discounted price is the same no matter whether you use the coupon or receive 15% off from the sale. How much did the pair of shoes cost?

Task #2: Equation Problems

1. Three girls downloaded a total of 36 songs on their iPods. Jane downloaded twice as many as Inez and since Tracy wanted to have the most, she downloaded one more than Jane did. How many songs did each girl download?

2. A checking account is set up with an initial balance of $4,800, and $300 is removed from the account each month for rent (no other transactions occur on the account). How many months will it take for the account balance to reach $1,500?

3. Peyton is three years younger than Justin. Matt is four times as old as Peyton. If you add together the ages of Justin, Peyton and Matt, the total comes to 39 years. How old are Justin, Peyton, and Matt?

Task #3: Gasoline Cost

You have $40 to spend on n gallons of gas that costs $3.25 per gallon. Determine whether each of the following is an expression or an equation. Using the structure, give an interpretation of the practical meaning of each.

1. 3.25n

2. 3.25n = 26

3. 40 - 3.25n

4. 40 - 3.25n = 1.00

Task #4: Equations and Solutions

For each of the equations below, determine whether the given value is a solution or not.

1. $x + 2 = x^2 + 4$ at $t = 2$

2. $p + 2 = p^2 - 4$ at $t = -2$

3. $\frac{a-5}{a+5} = 1$ at $a = 0$

4. $\frac{5-a}{5+a} = -1$ at $a = 0$

5. $3(x-8) = 3x-8$ at $x = 0$

Which, out of the numbers 0, 1, -1, 2, -2, is/are solution(s) to the equation $4x^2 + 4x - 5 = 2x(x+3) - 1$?

Task #5: Same Solution?

Which of the following equations have the same solution? Give reasons for your answer that does not depend on solving the equations.

I. $x + 3 = 5x - 4$

II. $x - 3 = 5x + 4$

III. $2x + 8 = 5x - 3$

IV. $10x + 6 = 2x - 8$

V. $10x - 8 = 2x + 6$

VI. $0.3 + \frac{x}{10} = \frac{1}{2}x - 0.4$

(http://www.illustrativemathematics.org/illustrations/613)

Task #6: Equivalent or Not?

For each pair of equations, determine whether the second equation is the result of a valid operation on the first. If so, what is the operation?

1. $7 + 5x = 3 - 2x$ and $7 + 7x = 3$

2. $3(x - 4) = 15$ and $x - 4 = 15$

3. $x^2 = 6x$ and $x = 6$

4. $\frac{1}{(x - 5)} = 10$ and $1 = 10(x - 5)$

Task #7: Study Questions

You and a friend of getting ready to study for an assessment on expressions and equations. Knowing that your friend is still getting expressions and equations mixed up and doesn't always know how to tell if two expressions or two equations are equivalent, your job is to create a set of problems (and solutions) to help your friend study. Create a minimum of six problems that will address your friend's misconceptions and include the solutions for her/him to study. Make sure your reasoning is clearly articulated in the solutions.

Task #8: How Does the Solution Change?

In the equations (a)-(d), the solution x to the equation depends on the constant a. Assuming a is positive, what is the effect of increasing a on the solution? Does it increase, decrease or remain unchanged? ***Give a reason for your answer that can be understood without solving the equation.***

a) $x-a = 0$

b) $ax = 1$

c) $ax = a$

d) $\frac{x}{a} = 1$

(http://www.illustrativemathematics.org/illustrations/614)

Task #9: Headphones

A store sells two brands of headphones: high definition (HD) and basic. It buys x HD headphones at z dollars each, and y basic headphones at w dollars each.

In a-c, write an equation whose solution is the given quantity. Do not solve the equations, just set them up.

a) The number of basic headphones the store can purchase if it spends a total of $10,000 on headphones and buys 110 HD headphones for $70 each.

b) The price the store pays for HD headphones if it spends a total of $2,000 on headphones and buys 55 basic headphones for $20 each.

c) The price the store pays for HD headphones if it spends a total of $800 on headphones and buys eight basic headphones for $80 each.

Task #10: Buying a Car

Suppose a friend tells you she paid a total of $16,368 for a car, and you'd like to know the car's list price (the price before taxes) so that you can compare prices at various dealers. Find the list price of the car if your friend bought the car in:

a) Arizona, where the sales tax is 6.6%.

b) New York, where the sales tax is 8.25%.

c) A state where the sales tax is r.

d) Solve for *r* in your answer to (c) above.

(http://www.illustrativemathematics.org/illustrations/582)

Task #11: Literal Equations

a) $A = hw$, solve for h.

b) $P = 2w + 2h$, solve for w.

c) $V = \pi r^2 h$, solve for h (or r if you have spent time with square roots).

d) $h = v_0 t + \frac{1}{2}at^2$, solve for a.

e) $\frac{(2xy - 7)}{3xy + 8} = 1$, solve for y.

Task #12: Equations and Formulas

Use inverse operations to solve the equations for the unknown variable or for the designated variable if there is more than one. If there is more than one operation to "undo," be sure to think carefully about the order in which you do them. For equations with multiple variables, it may help to first solve a version of the problem with numerical values substituted in.

a. $5 = a - 3$

b. $A - B = C$ (solve for A)

c. $6 = -2x$

d. $IR = V$ (solve for R)

e. $\frac{x}{5} = 3$

f. $W = \frac{A}{L}$ (solve for A)

g. $7x + 3 = 10$

h. $ax + c = R$ (solve for x)

i. $13 = 15 - 4x$

j. $2h = w - 3p$ (solve for p)

k. $F = \frac{GMm}{r^2}$ (solve for G)

(http://www.illustrativemathematics.org/illustrations/393)

Task 13: Evan and Megan

- Evan, will be given a number between zero and 999.
- Evan multiplies the number by four and gives the result to Megan.
- Whenever Megan gets a number, she subtracts it from 2,000 and passes the result back to Evan.
- Evan multiplies that by four and passes the number back to Megan, etc.
- The winner is the last person who produces a number less than 1,000.

Break into pairs and record a couple of iterations of the game on a similar table:

Name	1	2	3	4
Evan	200	400		
Megan	800	1600		

In the example above, Megan wins in round two since Evan produced a number greater than 1,000.

Name	1	2	3	4
Evan	300			
Megan	1200			

In the example above, Megan wins in round one since Evan produced a number greater than 1,000. Thus we see in this case, large values cause Evan to lose whereas in the previous game, when Evan received a large number initially, he won.

How can this situation be represented as an inequality? Work in your groups to set up and solve an inequality.

Task #14: Inequality Behavior

In each case, describe what operations occurred to move from the direct, previous line. Using what you know about the structure of our number system, make a decision for the inequality symbol.

Beginning Numbers		Description of operation	Inequality	
2	5	Begin	2 < 5	
4	10	Multiplied by 2	4 < 10	
-1	5		-1	5
5	-25		5	-25
15	-15		15	-15
3	-5		3	-5
-3	5		-3	5

What operations appear to be “flipping” the sign?

What is true about the negative number system?

Does adding and subtracting by a negative number ALWAYS/SOMETIMES/NEVER produce an opposite number? Explain.

Does multiplying and dividing by a negative number ALWAYS/SOMETIMES/NEVER produce an opposite number? Explain.

Task #15: Fishing Adventures

Fishing Adventures rents small fishing boats to tourists for day-long fishing trips. Each boat can only carry 1,200 pounds (lbs) of people and gear for safety reasons. Assume the average weight of a person is 150 pounds. Each group will require 200 pounds of gear for the boat plus 10 pounds of gear for each person.

a) Create an inequality describing the restrictions on the number of people possible in a rented boat. Graph the solution set.

b) Several groups of people wish to rent a boat. Group one has four people. Group two has five people. Group three has eight people. Which of the groups, if any, can safely rent a boat? What is the maximum number of people that may rent a boat?

(http://www.illustrativemathematics.org/illustrations/643)

Task #16: Sports Equipment Set

Jonathan wants to save up enough money so that he can buy a new sports equipment set that includes a football, baseball, soccer ball, and basketball. This complete boxed set costs $50. Jonathan has $15 he saved from his birthday. In order to make more money, he plans to wash neighbors' windows. He plans to charge $3 for each window he washes, and any extra money he makes beyond $50 he can use to buy the additional accessories that go with the sports box set.

Write and solve an inequality that represents the number of windows Jonathan can wash in order to save at least the minimum amount he needs to buy the boxed set. Graph the solutions on the number line. What is a realistic number of windows for Jonathan to wash? How would that be reflected in the graph?

(http://www.illustrativemathematics.org/illustrations/986)

Task #17: Basketball

Chase and his brother like to play basketball. About a month ago they decided to keep track of how many games they have each won. As of today, Chase has won 18 out of the 30 games against his brother.

a. How many games would Chase have to win in a row in order to have a 75% wining record?

b. How many games would Chase have to win in a row in order to have a 90% winning record?

c. Is Chase able to reach a 100% winning record? Explain why or why not.

d. Suppose that after reaching a winning record of 90% in part (b), Chase had a losing streak. How many games in a row would Chase have to lose in order to drop down to a winning record below 55% again?

(http://www.illustrativemathematics.org/illustrations/702)

Task #18: Solving Inequalities

Solve each of the following. Explain each step in your work, and check your answers.

1. Jane plans to purchase three pairs of slacks all costing the same amount, and a blouse that is $4 cheaper than one of the pairs of slacks. She has $75 to spend but wants to have at least $3 left. What is the price range for the slacks?

2. $(-3x + 7) - 4(2x - 6) - 12$ is ≥ 7

3. $-3(5x - 3)$ is $< 4(x + 3) - 12$