

M²=Math Mediator Lesson 5: Linear Equations

<p>Total Recall (Warm-up) (5 minutes approx.)</p>	<p>Total Recall: Exercise from yesterday's lesson on area and Equations</p> <p>1. A cake needs to be frosted. It is a three layer cake, made from three cakes with the dimensions of: 13" x 19" x 2". What is the total area that needs to be frosted?</p> <p>A: All three will have frosting on the top and sides (this assumes you would like frosting between layers, because the three will be stacked on each other). The formula is: $3(\text{top area}) + 3(2\text{long sides}) + 3(2\text{short sides}) = \text{total area}$. The top areas are $3(13 \times 19) = 3 \cdot 247 = 741$ sq. in.; two long sides are $2(19 \cdot 2) = 76$ sq. in.; two short sides are $2(13 \cdot 2) = 52$ sq.in. for a total of 869 sq.in. of surface area.</p>
<p>Direct Instruction (15 minutes approx.)</p>	<p>Have students work on the following exercises:</p> <p>2. Applying frosting at 1/8" deep to all these sides would produce a volume of frosting that would be needed for this project. What is that volume?</p> <p>A: Take the surface area and multiply by the depth of 1/8" or 0.125" $\cdot 869 = 108.6 \text{ in}^3$.</p> <p>3. A container of pre-made frosting at the store is typically sold in a 4" round and 4" tall cylindrical container. How much volume of frosting is that? How many containers would you need to frost the three layer cake?</p> <p>A: Volume of cylinder is $\pi r^2 h$ or $\pi 2^2 \cdot 4 = 50.3 \text{ in}^3$. You might get by with 2 containers, but three would provide extra thickness.</p> <p>4. Use the variables L (length); W (width); H (height); D (depth); and N (number layers) to write a formula to save as a cake chef for determining frosting needed on future rectangular cakes. This formula can be saved in a spreadsheet for quick calculations.</p> <p>A: Frosting = $N \cdot D[(L \cdot W) + 2(L \cdot H) + 2(W \cdot H)]$</p> <p>5. What about round cakes? How many square inches of surface area would you have for two layers of an 8" round cake, with 2" of height? What is the volume of frosting needed?</p> <p>A: Surface Area = $2(\text{top}) + 2(\text{side}) = 2(\pi r^2) + 2(\pi dh) = 2(\pi 4^2) + 2(\pi \cdot 8 \cdot 2) = 32\pi + 32\pi = 64\pi = 201.1 \text{ sq. in.}$</p> <p>Now you students are cake frosting quantity experts!</p>
<p>Review (5 minutes approx.)</p>	<p>Over the past few days the following topics have been discussed:</p> <ul style="list-style-type: none"> • Expressions and Exponents; like terms; coefficients • Properties and subsets of numbers; unit conversions • Order of Operations; formulas and taking trips <p>If you don't remember these, please go back and review. Next subject is solving equations and inequalities with absolute values. And probably a quiz is not too far off in the future.</p>
<p>Direct Instruction and Practice</p>	<p>Linear Equations:</p> <p>Some of you babysit. If you babysat for 3 hours and you agreed to do it for</p>

M²=Math Mediator

Lesson 5: Linear Equations

<p>(10 minutes approx.)</p>	<p>\$15.00 per hour plus if everything went okay you'd get a \$5.00 tip (this would be negotiated and agreed on with the parents before taking on the job) how much total did you make? First, write an equation, and then solve it:</p> $3(15) + 5 = \text{total earned} = \50.00 <p>You talk to your friend, Lisa, and find out she earned \$40.00, including a \$5.00 tip, and also worked for 3 hours. What was her rate of earning?</p> <p>Let x equal Lisa's rate of earning: $3(x) + 5 = 40$ is the equation (different from an expression, because of the equal sign). 3 is a coefficient; 5 and 40 are constants, and x is the variable. Solving for x we get:</p> $3x + 5 = 40 \text{ (subtract 5 from both sides)}$ $3x = 35 \text{ (divide both sides by 3)}$ $x = 11.67 \text{ (the answer is \$11.67 per hour)}$ <p>There are many uses for linear equations besides babysitting calculations:</p> <ul style="list-style-type: none"> - Travel calculations: 5 hours traveling at 60 miles/hour = x hours - Commission on sales: Base salary + %(sales) = earnings - Savings account: Amount + Interest(Amount) = Total Savings
<p>Direct Instruction; practice and assessment: (15 minutes approx.)</p>	<p>Properties of Equations:</p> <ol style="list-style-type: none"> 1. Any number is equal to itself: $a = a$ Reflexive Property 2. Equations are symmetric: $a = b$ and $b = a$ Symmetry Property 3. Transfer equalities: if $a = b$ and $b = c$ then $a = c$ Transitive Property 4. You can substitute or replace: if $a = b$ and $3 = 4b - 2$, then $3 = 4a - 2$ Substitute Property 5. Whatever you do to one side, do to other: if $a = b$; then $a + c = b + c$; and $a - c = b - c$; and $a \cdot c = b \cdot c$ and $a \div c = b \div c$ Transformation Property <p>Using these properties; solve the following:</p> <ol style="list-style-type: none"> 1. $3x + 5 = 65$ A: $x = 20$ 2. $(1/2)y - 3 = 15$ A: $y = 36$ 3. $1000 + (0.06)x = 1030$ $x = 500$ 4. $60y + 500(3) = 1680$ A: $y = 3$ (60 is mi/hr; 500(3) is 3 hours in an airplane at 500 miles per hour; and 1680 is the total miles; y is the number of hours driving). 5. $4(x-2) + 1 = 25$ A: $x = 8$ 6. $6(x-5) = x + 5$ A: $x = 7$
<p>Exercise: (10 minutes approx.)</p>	<p>If it takes one person (Roger) 10 minutes to wash a car and if his friend, Daniel, helps only 7 minutes per car; then how many cars must they wash to make \$100.00 each at 5 cars an hour, charging \$10.00 per car? With an average rate of 5 cars an hour (already given); how long will it take them to make the \$100.00 each?</p>

M²=Math Mediator Lesson 5: Linear Equations

	<p>A: First write down what you know: \$10.00 per car; need to make \$200.00; so need 20 cars. $10x = 200$; $x = 20$ $5(\text{cars}/\text{hour}) \text{ times } 10 (\text{dollars}/\text{car}) = 50 (\text{dollars}/\text{hour})$ watch units! Since two people are working; they each get \$25 per hour; so they need 4 hours to make \$100.00.</p>
<p>Wrap-up and homework assignment (5 minutes approx.)</p>	<p>Wrap up closing comments and housekeeping. Suggest students pick one of the following homework to give them a chance to practice.</p> <p>1. The length of a rectangle is twice the width. Find the width if the perimeter is 60 cm. A: $L = 2W$; $2(W) + 2(L) = \text{perimeter} = 60 \text{ cm} = 2(W) + 2(2W)$ due to substitution and $W = 12 \text{ cm}$; and $60 \text{ cm} = L + 2L$ for length; giving $L = 20 \text{ cm}$.</p> <p>2. Louis and 3 friends went golfing. Two of the friends rented clubs for \$6.00 each. The total cost was \$76.00 for all four of them combined. How much was the green fee? A: Let $g = \text{green fee}$ and total cost equals green fees plus club rentals or $76 = 4(g) + 2(6)$; solving for $g = 16$ dollars.</p> <p>3. When Carla rented a moving van, she agreed to pay \$28.00 per day plus 42 cents per mile. If she kept the van for 3 days and the total cost was \$153.73, how many miles did she travel in the van? Ignore taxes and any extras. A: Let $m = \text{miles}$: $(28)3 + (.42)m = 153.72$; $m = 166$ miles.</p>