

8th Grade Honors – Variable Manipulation Part 1 Student**EVALUATING AN EXPRESSION (PLUG IN VALUE)**

To evaluate an algebraic expression, plug in the given values for the unknowns and calculate according to PEMDAS. To find the value of $x^2 + 5x - 6$ when $x = -2$, plug in -2 for x :

$$(-2)^2 + 5(-2) - 6 = 4 - 10 - 6 = -12$$

Use plugging In

- when there are variables in the answer choices
- when solving word problems or plug-and-chug questions
- for questions of any difficulty level

WHAT TO DO WHEN YOU PLUG IN

1. **Identify the opportunity.** Can you plug in on This question?
2. **Choose a good number.** Make the math easy on yourself.
3. **Find a target answer.** Answer The question posed in The problem with your number, and circle your target answer.
4. **Test all the answer choices.** If two of them work, Try a new number.

HIDDEN PLUG-INS

Both of the above questions have had variables in the answer choices, which is dead giveaway that we can Plug In. The good news is that that's not the only time. In any problem in which there are hypothetical values or values relative to each other, Plugging In will work.

Example: If $x - z = 6$ and $y = 3x - 2 - 3z$. then $y = ?$

- a. 2
- b. 4
- c. 14
- d. 16
- e. 18

Solution: There aren't any variables in the answer choices, but notice all values in problem are defined relative to one another. Let's Plug In.

Using the first equation in the problem, let's make the numbers easy on ourselves and say $x = 8$ and $z = 2$. Using these values, let's find the value for the express given in the problem: $y = 3(8) - 2 - 3(2) = 24 - 2 - 6 = 16$, choice (D).

PLUGGING IN THE ANSWERS

Plugging In is a great strategy when there are variables in the question or the answers. How about when there aren't? Does that mean we have go back to algebra? Of course not! On most problems on the ACT, there are a variety of ways to solve.

PLUG IN THE ANSWERS (PITA) when

- answer choices are numbers in ascending or descending order
- the question asks for a specific amount. Questions will usually be "what?" or "how many?"
- you see the urge to do algebra even when there are no variables in the problem

Because many answer choices are listed in ascending order, it will be best to to start with the middle choice. That way, if it's too high or too low, we'll be able to use process of elimination (POE) more efficiently.

Example: In a piggy bank, there are pennies, nickels, dimes, and quarters that total \$2.17 in value. If there are 3 times as many pennies as there are dimes, 1 more dime than nickels, and 2 more quarter than dimes, then how many pennies are in the piggy bank?

- 12
- 15
- 18
- 21
- 24

Solution:

- Know the question.** How many pennies are in the bank?
- Let the answers help.** There are no variables, but the very specific question coupled with the numerical answers in ascending order gives a pretty good indication we can PITA.
- Break the problem into bite-sized pieces.** Make sure you take your time with this problem, because you'll need to multiply the number of each coin by its monetary value. In other words, don't forget that 1 nickel will count for 5 cents, 1 dime will count for 10 cents, and 1 quarter will count for 25 cents. Let's set up some columns to keep our work organized and begin with choice (C).

Since ACT has already given us the answers, we will plug those answers in and work backwards. Each of the answers listed gives a possible value for the number of pennies. Using the information in the problem, we can work backwards from that number of pennies to find the number of nickels, dimes, and quarters. When the values for the number of coins adds up to \$2.17, we know we're done.

If we begin with the assumption that there are 18 pennies, then there must be 6 dimes (3 times as many pennies as there are dimes). 6 dimes means 5 nickels (1 more dime than nickels) and 8 quarters (2 more quarters than dimes).

Now multiply the number of coins by the monetary value of each and see if they total \$2.17.

| Pennies (\$P) | Dimes (\$D) | Nickels (\$N) | Quarters (\$Q) | Total = \$2.17 |
|----------------|-------------|---------------|----------------|---------------------|
| c. 18 (\$0.18) | 6 (\$0.60) | 5 (\$0.25) | 8 (\$2.00) | Total = \$3.03 (NO) |

That's too high, so not only is choice (C) incorrect, but also choices (D) and (E). Cross them off and try choice (B).

| Pennies (\$P) | Dimes (\$D) | Nickels (\$N) | Quarters (\$Q) | Total = \$2.17 |
|----------------|-------------|---------------|----------------|----------------------|
| a. 12 (\$0.12) | 4 (\$0.40) | 3 (\$0.15) | 6 (\$1.50) | Total = \$2.17 (YES) |
| b. 15 (\$0.15) | 5 (\$0.50) | 4 (\$0.20) | 7 (\$1.75) | Total = \$2.60 (NO) |
| c. 18 (\$0.18) | 6 (\$0.60) | 5 (\$0.25) | 8 (\$2.00) | Total = \$3.03 (NO) |

NOTE ON PLUGGING IN AND PITA

Plugging In and PITA are not the only ways to solve these problems. The "best" way is the easiest way you can answer the problems. When you solve in a more complex way, there are a lot more opportunities to make careless errors.

PLUGGING IN: NOT JUST ALGEBRA

Remember what the main requirements are for a Plugging In problem. You need variables in the answer choices or question: that's it. It doesn't say anywhere that the problem needs to be a pure algebra problem. What is a pure algebra problem anyway? Don't forget: Part of what makes this test so hard is that ACT piles concept on top of concept in its problems. In other words, geometry problems often are algebra problems.

Sample Questions:

1. If $r = 9$, $b = 5$, and $g = -6$, what does $(r + b - g)(b + g)$ equal?

2. If $n = 10$, then which of the following represents 552?

- a. $5n + 2$
- b. $5n^2 + 2$
- c. $5n^2 + 5n + 2$
- d. $5n^3 + 5n + 2$
- e. $5n^4 + 5n + 2$

3. When $n = \frac{1}{4}$, what is the value of $\frac{2n - 5}{n}$?

4. Charles defined a new operation, \blacksquare , on pairs of ordered pairs of integers as follows: $(a,b) \blacksquare (c,d) = \frac{ac+bd}{ab-cd}$.
What is the value of $(2,1) \blacksquare (3,4)$?

5. What is the value of the expression $10(100x - 10,000) + 100$ when $x = 250$?

6. If $-3/(a - 3) = 3/(a + 2)$, then $a = ?$

ADDING AND SUBTRACTING MONOMIALS {COMBINING LIKE TERMS}

To combine like terms, keep the variable part unchanged while adding or subtracting the coefficients (numbers):

$$2a + 3a = (2 + 3)a = 5a$$

Sample Question:

7. For all x , $13 - 2(x + 5) = ?$

SOLVING A LINEAR EQUATIONS (SOLVE FOR X)

To solve an equation, isolate the variable. As long as you do the same thing to both sides of the equation, the equation is still balanced. To solve $5x - 12 = -2x + 9$, first get all the x terms on one side by adding $2x$ to both sides: $7x - 12 = 9$. Then add 12 to both sides: $7x = 21$, then divide both sides by 7 to get: $x = 3$.

Sample Questions:

8. For what value of a is the equation $3(a + 5) - a = 23$ true?

9. If $4(x - 2) + 5x = 3(x + 3) - 11$, then $x = ?$

10. If $8y = 3x - 11$, then $x =$

- a. $(88/3)y$
- b. $(8/3)y + 11$
- c. $(8/3)y - 11$
- d. $(8y - 11)/3$
- e. $(8y + 11)/3$

11. If $5x + 5 = 25 + 3x$, then $x = ?$

12. If $9(x - 9) = -11$, then $x = ?$

13. If $7 + 3x = 22$, then $2x = ?$

14. If $4(x - 2) + 5x = 3(x + 3) - 11$, then $x = ?$

15. If $x + \frac{2}{3} = \frac{8}{21}$, then $x = ?$

16. When $\frac{1}{3}k + \frac{1}{4}k = 1$, what is the value of k ?

17. The total weekly profit p , in dollars, from producing and selling x units of a certain product is given by the function $p(x) = 225x - (165x + c)$, where c is a constant. If 75 units were produced and sold last week for a profit of \$3,365, what is the value of c ?

NO OR INFINITE SOLUTIONS TO EQUATIONS (SOLVE FOR X)

When you try to solve an equation, you are starting from the (unstated) assumption that there actually is a solution. When you end up with nonsense (like the nonsensical equation " $4 = 5$ " above), this says that your initial assumption (that there was a solution) was wrong; in fact, there is no solution. Since the statement " $4 = 5$ " is utterly false, and since there is no value of x that ever could make it true, then this equation has no solution. This is not the same as a solution where $x = 0$. Don't confuse these two very different situations: "the solution exists and has the value of zero" is not in any manner the same as "no solution value exists at all".

Example: Solve $11 + 3x - 7 = 6x + 5 - 3x$

Solution: First, combine like terms; then solve:

$$11 + 3x - 7 = 6x + 5 - 3x$$

$$4 + 3x = 3x + 5$$

$$\begin{array}{r} -3x \quad -3x \\ \hline 4 \quad = \quad 5 \end{array}$$

The "solution" is "no solution".

What if the answer you get is $5 = 5$? Is there any value of x that would make that statement false? Since there is no " x " in the solution, the value of x is irrelevant: x can be anything. So the solution is "all x ". This solution could also be stated as "all real numbers" or "all reals" or "the whole number line"; expect some variation in lingo from. Note that, if I had solved the equation by subtracting a 5 from either side of $5 + 4x = 5 + 4x$ to get " $4x = 4x$ ", I would have ended up with nothing other than another trivially-true statement. I could also have subtracted both $4x$ and 5 from both sides to get " $0 = 0$ ", but the solution would still be the same: "all x ". Don't be surprised if, for "all real numbers" or "no solution" equations, you don't necessarily have the exact same steps as some of your fellow students. Since there are infinitely-many always-true equations (like " $0 = 0$ ") and infinitely-many nonsensical equations (like " $3 = 4$ "), there will be many ways of arriving at these answers.

Example: Solve $6x + 5 - 2x = 4 + 4x + 1$

Solution: First, combine like terms; then solve:

$$6x + 5 - 2x = 4 + 4x + 1$$

$$4x + 5 = 5 + 4x$$

$$\begin{array}{r} -4x \quad -4x \\ \hline 5 \quad = \quad 5 \end{array}$$

Sample Question:

18. Which of the statements describes the solution set for $-2(x + 8) = -2x + 20$?
- $x = -2$ only
 - $x = 0$ only
 - $x = 20$ only
 - There are no solution for this equation.
 - All real numbers are solutions of this equation.

TRANSLATING FROM ENGLISH INTO ALGEBRA (PLUG IN)

The next part of variable manipulation problems is to figure out the problem from real life situations. These problems have a lot of wording to help explain the problem in English format. Some of the problems will have the equation within the explanation. There will usually be an explanation of the variables and the value of the variables.

Example: While doing research on the climates of South American countries, Andrea notices that all of the temperatures are given in degrees Celsius. Because she is not as familiar with Celsius temperature scale, it is difficult for her to know whether a location with an average temperature of 25°C has a warm climate. Fahrenheit, F , and Celsius, C , are related by the formula $F = \left(\frac{9}{5}\right)C + 32$. What is the temperature in degrees Fahrenheit of the location with an average temperature 25°C ?

Solution: The equation for this problem is $F = \left(\frac{9}{5}\right)C + 32$ as listed within the problem. The problem also states that C is the degrees Celsius and says to find the degrees F when degrees C is equal to 25? So plug in 25 for C and solve for F .

$$F = \left(\frac{9}{5}\right)C + 32 = \left(\frac{9}{5}\right)25 + 32 = 45 + 32 = 77$$

Sample Questions:

19. The length L , in meters, of a spring is given by the equation $L = (2/3)F + 0.05$, where F is the applied force in newtons. Approximately what force, in newtons, must be applied for the spring's length to be 0.23 meters?
20. A formula for calculating simple interest is $I = Pr$, where I is the interest earned in dollars, P is the principal or original investment, and r is the fixed rate of interest. If the amount of interest earned is \$2.25 and the interest rate is 3%, what is P ?
21. A formula used to compute the current value of an investment account is $A = P(1 + r)^n$, where A is the current value, P is the amount deposited, r is the rate of interest for 1 compounding period, expressed as a decimal, and n is the number of compounding periods. Which of the following is closest to the value of an investment account after 3 years if \$8,000 is deposited at 5% annual interest compounded annually?

22. Molality, m , tells us the number of moles of solute dissolved in exactly 1 kilogram (kg) of solvent. Molality is represented by the equation, $m = \frac{s}{k}$, where s represents the moles of solute and k represents the mass of the solvent in kilograms. A solution is known to have a molality of 0.2 and contain 13 kg of solvent. What is the number of moles of solute contained in the solution?
23. A car accelerated from 88 feet per second (fps) to 220 fps in exactly 3 seconds. Assuming the acceleration was constant, what was the car's acceleration, in feet per second per second, from fps to 220 fps?
24. Joelle earns her regular pay of \$7.50 per hour for up to 40 hours of work in a week. For each hour over 40 hours of work in a week, Joelle is paid $1\frac{1}{2}$ times her regular pay. How much does Joelle earn for a week in which she works 42 hours?
25. For a population that grows at a constant rate of $r\%$ per year, the formula $P(t) = p_0(1 + \frac{r}{100})^t$ models the population t years after an initial population of p_0 people is counted. The population of the city of San Jose was 782,000 in 1990. Assume the population grows at a constant rate of 5% per year. According to this formula, which of the following is an expression for the population of San Jose in the year 2000?
- $782,000(6)^{10}$
 - $782,000(1.5)^{10}$
 - $782,000(1.05)^{10}$
 - $(782,000 \times 1.5)^{10}$
 - $(782,000 \times 1.05)^{10}$
26. Two professors were hired to begin work at the same time. Professor A's contract called for a starting salary of \$50,000 with an increase of \$1,500 after each year of employment. Professor B's contract called for a starting salary of \$42,000 with an increase of \$2,800 after each year of employment. If y represents the number of full years of employment (that is, the number of yearly increases each professor has received,) which of the following equations could be solved to determine the number of years until B's yearly salary equals A's yearly salary?
- $50,000 + 1,500y = 42,000 + 2,800y$
 - $50,000 + 2,800y = 42,000 + 1,500y$
 - $1,500y + 2,800y = y$
 - $1,500y + 2,800y = 42,000$
 - $1,500y + 2,800y = 50,000$
27. A certain brand of cereal costs \$3.25 per box before sales tax is added. When you buy 5 or more boxes of this cereal you receive 1 additional box for free. What is the average cost per box of cereal for 6 boxes before sales tax is added?

TRANSLATING FROM ENGLISH INTO ALGEBRA (EQUATIONS)

To translate from English into algebra, look for the key words and work from left to right to turn phrases into algebraic expressions. Be careful about order, especially when subtraction is called for.

Example: For all real numbers b and c such that the product of c and 10 is b , which of the following expressions represents the product of c and 3 in terms of b ?

- a. $b + 10$
- b. $3b + 30$
- c. $3(b + 3)$
- d. $\frac{b+3}{3}$
- e. $\frac{b}{3} + 3$

Solution: The sum of c and 10 is b is translation by knowing that sum means addition and is means equal to. The equation for the first phrase is written as $c + 10 = b$. Solving for c becomes $c = b - 10$. Substitute that for c into the second equation and get $c \times 3 = (b-10) \times 3 = 3b - 30$ or B.

Sample Questions:

28. If each element in a data set is multiplied by 3, and each resulting product is then reduced by 4, which of the following expressions gives the resulting data set in terms of x ?

- a. x
- b. $3x - 4$
- c. $x + \frac{4}{3}$
- d. $\frac{x}{3} + 4$
- e. $x + \frac{3}{4}$

29. Which of the following mathematical expressions is equivalent to the verbal expression "A number, x , squared is 39 more than the product of 10 and x "?

- a. $x^2 = 39 \times 10x$
- b. $x^2 = 39 + 10x$
- c. $x^2 = 390 - 10x$
- d. $x^2 = 39x + 10$
- e. $x^2 = 390 + 10x$

TRANSLATING FROM ENGLISH INTO ALGEBRA (STORY PROBLEMS)

To translate from English into algebra, look for the key words and work from left to right to turn phrases into algebraic expressions and sentences into equations. Be careful about order, especially when subtraction is called for.

Example: The charge for a phone call is r cents for the first 3 minutes and s cents for each minute thereafter. What is the cost, in cents, of a call lasting exactly t minutes? ($t > 3$)

Solution: The charge begins with r , and then something more is added, depending on the length of the call. The amount added is s times the number of minutes past 3 minutes. If the total number of minutes is t , then the number of minutes past 3 is $t - 3$. So the charge is $r + s(t - 3)$.

Three steps to help solve Word Problems

1. **Know the question.** Read the whole problem before calculating anything and underline the actual question.
2. **Let the answers help.** Look for clues on how to solve and ways to use process of elimination (POE)
3. **Break the problem into bite-sized pieces.** When you read the problem a second time, calculate at each step necessary and watch out for tricky phrasing.

Example: Each member in a club had to choose an activity for a day of volunteer work. $\frac{1}{3}$ of the members chose to pick up trash. $\frac{1}{4}$ of the remaining members chose to paint fences. $\frac{5}{6}$ of the members still without tasks chose to clean school busses. The rest of the members chose to plant trees. If the club has 36 members, how many of the members chose to plant trees?

- a. 3
- b. 6
- c. 9
- d. 12
- e. 15

Solution:

Step 1: Know the Question. This is actually a slightly tricky step on this one. First of all, the problem doesn't tell you until the very end that there are 36 students in this class. Without this piece of information, the fractions don't mean much of anything. Second, the question is asking for the number of members who chose to plant trees, and we're going to have to figure out a bunch of other things before we figure that out.

Step 2: Let the Answers Help. There aren't any crazy answers in this one, though if you noticed how much we're subtracting from 36, you're probably thinking that the answer will be one of the smaller numbers.

Step 3: Break the problem into bite-sized pieces. The starting point of this word problem actually comes at the end: This club has 36 members. Once you've got that, work the problem sentence by sentence, and pay particular attention to the language of the problem.

$\frac{1}{3}$ of the members chose to pick up trash. A nice easy way to start. There are 36 members, and $\frac{1}{3}$ of 36 is 12, so 12 members pick up trash.

$\frac{1}{4}$ of the remaining members chose to paint fences. This is just like the last piece, except for one HUGE exception, which comes from the word remaining. First, we'll need to figure out how many remaining members there are from the first step. There are 36 total members and 12 of them are picking up trash, so there are 24 members remaining. $\frac{1}{4}$ of 24 is 6, so 6 members paint fences.

$\frac{5}{6}$ of the remaining members still without tasks chose to clean school buses. There's that word remaining again. There were 24 members in the last step, but 6 of them chose to paint fences, so now there are 18 remaining members. $\frac{5}{6}$ of 18 is 15, so 15 members clean school buses.

The rest of the members chose to plant trees. There were 18 members left over in the last step, and 15 of them chose to clean school buses, which means there must be 3 students left to plant trees. Choice (A) is the correct answer.

Sample Questions:

30. The fixed costs of printing a certain textbook are \$900.00 per week. The variable costs are \$1.50 per textbook. Which of the following expressions can be used to model the cost of printing t textbooks in 1 week?

- a. $\$901.50t$
- b. $\$150t - \900.00
- c. $\$900.00t + \1.50
- d. $\$900.00 - \$1.50t$
- e. $\$900.00 + \$1.50t$

31. Two enterprising college students decide to start a business. They will make up and deliver helium balloon bouquets for special occasions. It will cost them \$39.99 to buy a machine to fill the balloons with helium. They estimate that it will cost them \$2.00 to buy the balloons, helium, and ribbons needed to make each balloon bouquet. Which of the following expressions could be used to model the total cost for producing b balloon bouquets?
- $\$ 2.00b + \39.99
 - $\$37.99b$
 - $\$39.99b + \$ 2.00$
 - $\$41.99b$
 - $\$79.98b$
32. The fixed costs of manufacturing basketballs in a factory are \$1,400.00 per day. The variable costs are \$5.25 per basketball. Which of the following expressions can be used to model the cost of manufacturing b basketballs in 1 day?
- $\$1,405.25b$
 - $\$5.25b - \$1,400.00$
 - $\$1,400.00b + \5.25
 - $\$1,400.00 - \$5.25b$
 - $\$1,400.00 + \$5.25b$
33. John Jones has decided to go into the business of producing and selling boats. In order to begin this venture, he must invest \$10 million in a boat production plant. The cost to produce each boat will be \$7,000, and the selling price will be \$20,000. Accounting for the cost of the production plant, which of the following expressions represents the profit, in dollars, that John will realize when x boats are produced and sold?
- $13,000x - 10,000,000$
 - $27,000x - 10,000,000$
 - $9,973,000x$
 - $20,000x$
 - $13,000x$
34. Leticia went into Discount Music to price CDs. All CDs were discounted 23% off the marked price. Leticia wanted to program her calculator so she could input the marked price and the discounted price would be the output. Which of the following is an expression for the discounted price on a marked price of p dollars?
- $p - 0.23p$
 - $p - 0.23$
 - $p - 23p$
 - $p - 23$
 - $0.23p$
35. A house painter charges \$24.00 per hour for a painting job that requires more than 5 hours to complete. For any job requiring 5 hours or less, the painter charges a flat fee of \$100. If n represents the number of hours the job requires, which of the following expressions gives the charge, in dollars, for a job requiring more than 5 hours to complete?
- 124.0
 - $-24n + 100$
 - $24n - 100$
 - $24n$
 - $24n + 100$

TRANSLATING FROM ENGLISH INTO ALGEBRA (SOLVE FOR X)

To translate from English into algebra, look for the key words and work from left to right to turn phrases into algebraic expressions and sentences into equations. Find the important numbers and write an equation that makes sense. Find out what answer the question is asking and solve your equation for the answer (solve for x) by using the order of operation rules (PEMDAS).

Example: The membership fees for WebFilms consists of a monthly charge of \$14 and a one-time new-member fee of \$16. Sherwood made a credit card payment of \$100 to pay his WebFilms fees for a certain number of months, including the new-member fee. How many months of membership did Sherwood include in his credit card payment?

- a. 4
- b. 6
- c. 7
- d. 12
- e. 14

Solution: Sherwood's \$100 payment covers both his one-time new-member fee and a few months of a membership. Since the new-member fee is \$16 and the monthly fee is \$14, put $(14 \times m)$ into the equation. The equation would be written as $14m + 16 = 100$. Solve for the number of months (m) by subtracting 16 from each side of the equation to get $14m = 84$. Divide both sides of the equation by 14 to get $m = 6$ or B.

Sometimes ACT problems have lots of words and complicated equations within the questions. When you see one of these type of problems, get excited because while these problems look complicated, they are usually very easy to solve.

Example: A formula for finding the value, A dollars, of P dollars invested at $i\%$ interest compounded annually for n years is $A = P(1 + 0.01i)^n$. Which of the following is an expression for P in terms of A , n and A ?

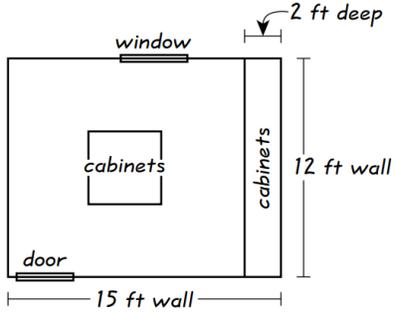
- a. $A - 0.01i^n$
- b. $A + 0.01i^n$
- c. $\left(\frac{A}{1+0.01i}\right)^n$
- d. $\frac{A}{(1-0.01i)^n}$
- e. $\frac{A}{(1+0.01i)^n}$

Solution: The formula for this problem is listed within the text. It looks complicated, $A = P(1 + 0.01i)^n$, however, the problem is just asking to solve in terms of P . Since P is multiplied by a bunch of stuff, just divide both sides of the equation by that bunch of stuff to get P alone. $P = A / (1 + 0.01i)^n$ or E.

Sample Questions:

36. Two professors were hired to begin work at the same time. Professor A's contract called for a starting salary of \$50,000 with an increase of \$1,500 after each year of employment. Professor B's contract called for a starting salary of \$42,000 with an increase of \$2,800 after each year of employment. If y represents the number of full years of employment (that is, the number of yearly increases each professor has received,) determine the number of years until b's yearly salary equals A's yearly salary?

37. Gianna is converting a 12-foot-by-15 foot room in her house to a craft room. Gianna will install tile herself but will have CC Installations build and install the cabinets. The scale drawing shown below displays the location of the cabinets in the craft room (0.25 inch represents 2 feet).



Cabinets will be installed along one of the 12-foot walls from floor to ceiling, and 4 cabinets that are each 3 feet tall will be installed in the middle of the room. These are the only cabinets that will be installed, and each of them will be 2 feet wide and 2 feet deep. CC Installations has given Gianna an estimate of \$2,150.00 for building and installing the cabinets.

CC Installations' estimate consists of a \$650.00 charge for labor, plus a fixed charge per cabinet. The labor charge and the charge per cabinet remain the same for any number of cabinets built and installed. CC Installations would give Gianna what estimate if the craft room were to have twice as many cabinets as Gianna is planning to have?

38. The minimum fine for driving in excess of the speed limit is \$25. An additional \$6 is added to the minimum fine for each mile per hour (mph) in excess of the speed limit. Rachel was issued a \$103 fine for speeding in a 55-mph speed limit zone. For driving at what speed, in mph, was Rachel fined?
39. An editor charges \$30 for each hour he works on a book project, plus a flat \$25 editing fee. How many hours of work are included in a \$190 bill for a book project?
40. Discount tickets to a basketball tournament sell for \$4.00 each. Enrico spent \$60.00 on discount tickets, \$37.50 less than if he had bought the tickets at the regular price. What was the regular ticket price?

TRANSLATING DATA TABLES INTO ALGEBRA

To translate from Data tables into algebra, look for a relationship within the data to turn into algebraic expressions and equations. Test your equation with the data. Find out what answer the question is asking and solve your equation for the answer (solve for x) by using the order of operation rules (PEMDAS). If the answers are equations, plug in the data from the table to see which is true.

Example: As a class experiment, a cart was rolled at a constant rate along a straight line. Shawn recorded in the chart below the cart's distance (x), in feet, from a reference point at the start of the experiment and for each of 5 times (t), in seconds.

| | | | | | | |
|---|----|----|----|----|----|----|
| t | 0 | 1 | 2 | 3 | 4 | 5 |
| x | 10 | 14 | 18 | 22 | 26 | 30 |

Which of the following equations represents this data?

- $x = t + 10$
- $x = 4t + 6$
- $x = 4t + 10$
- $x = 10t + 4$
- $x = 14t$

Solution: At constant speed, with every change of 1 second there is 4 feet change in distance (14-10, 22-18, etc.) Since the cart started at 10 feet, $x = 10 + 4t$ or C.

Sample Questions:

41. Which of the following equations corresponds the data in the table?

| x | y |
|-----|------|
| -20 | -1/8 |
| -10 | -1/3 |
| 0 | 1/2 |
| 5 | 2/9 |
| 20 | 1/12 |

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

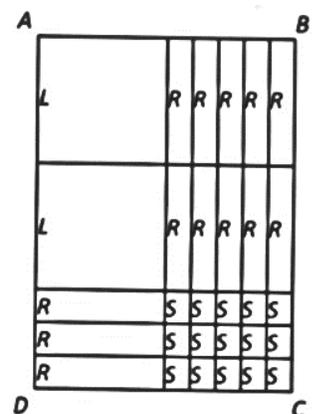
42. Which of the following describes the total number of dots in the first n rows of the triangular arrangement below?



- 30
- $2n$
- n^2
- $n(n + 1)$
- $2n + 2(n - 1)$

43. As shown in rectangle $ABCD$ is divided into 2 large squares (labeled L) each x inches on a side, 15 small squares (labeled S) each y inches on a side, and 13 rectangles (labeled R) each x inches by y inches. What is the total area, in square inches, of $ABCD$?

- $2x + 13xy + 15y$
- $6x + 16y$
- $2x^2 + 15y^2$
- $2x^2 + 8xy + 15y^2$
- $2x^2 + 13xy + 15y^2$



44. In the following table, every row, column, and diagonal must have equivalent sums. Which term or value belongs in the lower left cell for this to be true?

| | | |
|------|-------|-------|
| m | $-4m$ | $3m$ |
| $2m$ | 0 | $-2m$ |
| | $4m$ | $-m$ |

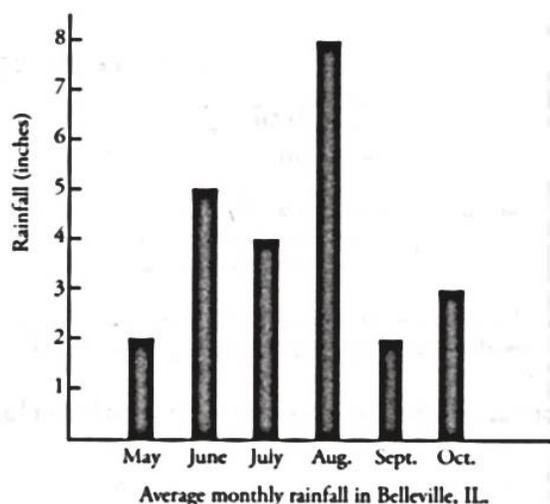
CHARTS AND GRAPHS

Since calculators were added to the arsenal you're allowed to bring with you when you take the ACT, more and more of the test has been composed of questions on which calculators are of little or no use, such as questions based on charts and graphs. On this type of question, your math skills aren't really being tested at all; what ACT is interested in is your ability to read a simple graph (similar to the Science Reasoning test). All of the questions we have seen in this format have been very direct. If you can read a simple graph, you can always get them right. What's most important on questions like these is paying attention to the labels on the information.

Example: Between which two months was the change in total rainfall the greatest?

- May and June
- June and July
- July and August
- August and September
- September and October

Solution: The ACT test writers want to see if you can decipher the information presented in the graph. Before you read the question then, you need to take a look at the graph. What is measured here? It says on the bottom: Average monthly rainfall in Belleville, IL. You should look at the values along the left side and bottom of the graph as well. When you do, you'll see that the rain is measured in inches (left-hand side), and the measurements were made each month (bottom).



Now for the question. To determine which two months had the greatest change, we need to compare the change between each pair of months, discarding the smaller ones until we have only one left. The difference from May to June is about 3, and that's larger than June to July and September to October, so choices (B) and (E) are out. July to August is larger still, though, so choice (A) is out, leaving only choices (C) and (D). It should be pretty apparent that the August to September change is larger than the July to August change, though, so the correct answer must be choice (D).

Answer Key

1. -20
2. C
3. -18
4. -1
5. 150,100
6. $\frac{1}{2}$
7. $-2x + 3$
8. 4
9. 1
10. $(8y + 11)/3$
11. 10
12. $70/9$
13. 10
14. 1
15. $-\frac{2}{7}$
16. $12/7$
17. 1,135
18. No solutions
19. 0.27
20. \$75.00
21. \$25,200
22. 2.6
23. 44
24. \$322.50
25. C
26. A
27. \$2.71
28. $3x - 4$
29. B
30. E
31. A
32. E
33. A
34. A
35. D
36. 7 years
37. \$3,650.00
38. 68
39. $5\frac{1}{2}$
40. \$6.50
41. B
42. B
43. E
44. $-3m$