Suggested ACT Math Approaches with Samples

Answering the Right Question. Take advantage of being allowed to mark on the test booklet by always underlining or circling what you're looking for. Using this technique will help you make sure that you're answering the right question.

Sample

1. If $x + 6 = 9$ then $3x + 1 =$

   A.   3

   B.   9

   C. 10

   D. 34

   E. 46

You should first circle or underline $3x + 1$ because this is what you're solving for. Solving for x leaves $x + 3$ and then substituting into $3x + 1$ gives $3(3) + 1$ or 10. The most common mistake is to solve for x, which is 3, and mistakenly choose **A.** as your answer. But remember, you're solving for $3x + 1$ not just x. You should also notice that most of the other choices would all be possible answers if you made common or simple mistakes. The correct answer is **C.** *Make sure you're answering the right question.*

Sample

2. If $A = \begin{bmatrix} 4 & -1 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & -1 \\ -4 & 2 \end{bmatrix}$, then $A - B = $?

   F. $\begin{bmatrix} 9 & -2 \\ -3 & 3 \end{bmatrix}$

   G. $\begin{bmatrix} -1 & -2 \\ 7 & 3 \end{bmatrix}$

   H. $\begin{bmatrix} 9 & 0 \\ -1 & -1 \end{bmatrix}$

   J. $\begin{bmatrix} -1 & 0 \\ 7 & -1 \end{bmatrix}$

   K. $\begin{bmatrix} 20 & 1 \\ -12 & 2 \end{bmatrix}$

You should first underline or circle $A - B$. To find the difference of matrices A and B, subtract the corresponding entries as follows.

$\begin{bmatrix} 4 & -1 \\ 3 & 1 \end{bmatrix} - \begin{bmatrix} 5 & -1 \\ -4 & 2 \end{bmatrix}$ $4 - 5 = -1$ $-1 - (-1) = 0$ $3 - (-4) = 7$ $1 - 2 = -1$

So the correct answer is

$\begin{bmatrix} -1 & 0 \\ 7 & -1 \end{bmatrix}$

which is choice **J.**

Work Forward. If you immediately recognize the method or proper formula to solve the problem, then do the work. Work forward.

Sample

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3. $|-8 + 6| + |-7| = ?$

    A.   21

    B.   9

    C.   7

    D.   −7

    E. −21

You should work this problem straight through as follows.

$$|-8 + 6| + |-7| = |-2| + |-7|$$

$$= 2 + 7$$

$$= 9$$

Notice that a quick look at the answer choices enables you to eliminate choices **D.** and **E.**, since they are negative. If you add two absolute values, the answer can't be negative.

> **Work Backward from the Answers. If** you don't immediately recognize a method or formula, or if using the method or formula would take a great deal of time, try working backward — from the answers. Since the answers are usually given in ascending or descending order, always start by plugging in the middle answer choice first if values are given. Then you'll know whether to go up or down with your next try. (Sometimes you might want to plug in one of the simple answers first.)

Sample

4. Which of the following is a value of r for which $r^2 - r - 20 = 0$?

    F.   4

    G.   5

    H.   6

    J.   7

    K.   8

You should first underline or circle "value of r." If you've forgotten how to solve this equation, work backward by plugging in answers. Start with choice **H.**; plug in 6.

$$(6)^2 - 6 - 20 \stackrel{?}{=} 0$$

$$36 - 6 - 20 \stackrel{?}{=} 0$$

$$30 - 20 \stackrel{?}{=} 0$$

$$10 \neq 0$$

Since this answer is too large, try choice **G.**, a smaller number. Plugging in 5 gives

$$5^2 - 5 - 20 \stackrel{?}{=} 0$$

$$25 - 5 - 20 \stackrel{?}{=} 0$$

$$20 - 20 \stackrel{?}{=} 0$$

$$0 = 0$$

which is true, so **G.** is the correct answer. *Working from the answers is a valuable technique.*

You could also work this problem by factoring into

$$(r - 5)(r + 4) = 0$$

and then setting $(r - 5) = 0$ and $(r + 4) = 0$ leaving

$r = 5$ or
$r = -4$

Sample

> **5.** Find the counting number that is less than 15 and when divided by 3 has a
> remainder of 1 and divided by 4 has a remainder of 2.
>
> **A.** 5
>
> **B.** 8
>
> **C.** 10
>
> **D.** 12
>
> **E.** 13

By working from the answers, you eliminate wasting time on other numbers from
1 to 14. Choices **B.** and **D.** can be immediately eliminated because they are divisi-
ble by 4, leaving no remainder. Choices **A.** and **E.** can also be eliminated because
they leave a remainder of 1 when divided by 4. Therefore, the correct answer is
C.; 10 leaves a remainder of 1 when divided by 3 and a remainder of 2 when di-
vided by 4.

Sample

> **6.** Barney can mow the lawn in 5 hours, and Fred can mow the lawn in 4 hours. How many hours will it take them to mow the lawn together?
>
> **F.** 1
>
> **G.** $2\frac{2}{9}$
>
> **H.** 4
>
> **J.** $4\frac{1}{2}$
>
> **K.** 5

First underline or circle "hours . . . mow the lawn together." Suppose that you're unfamiliar with the type of equation for this problem. Try the "reasonable" method. Since Fred can mow the lawn in 4 hours by himself, he'll take less than 4 hours if Barney helps him. Therefore, choices **H.**, **J.**, and **K.** are not sensible. Taking this method a little farther, suppose that Barney could also mow the lawn in 4 hours. Then together it would take Barney and Fred 2 hours. But since Barney is a little slower than this, the total time should be a little more than 2 hours. The correct answer is **G.**, $2\frac{2}{9}$ hours.

Using the equation for this problem would give the following calculations.

$$\frac{1}{5} + \frac{1}{4} = \frac{1}{x}$$

In 1 hour Barney could do $\frac{1}{5}$ of the job, and in 1 hour Fred could do $\frac{1}{4}$ of the job; unknown x is that part of the job they could do together in one hour. Now, solving, you calculate as follows.

$$\frac{4}{20} + \frac{5}{20} = \frac{1}{x}$$
$$\frac{9}{20} = \frac{1}{x}$$

Cross multiplying gives

$$9x = 20$$

Therefore,

$$x = \frac{20}{9}, \text{ or } 2\frac{2}{9}$$

Simplify. Sometimes, combining terms performing simple operations, or simplifying the problem in some other way will give you insight and make the problem easier to solve.

Sample

> **7.** If $x = -3$ and $y = 4$ then $xy^2 + 3x^2y + 4xy^2 + 2x^2y =$
>
>   **A.** -420
>
>   **B.** -60
>
>   **C.** 60
>
>   **D.** 420
>
>   **E.** $4,500$

Simplifying this problem means first adding the like terms $(xy^2 + 4xy^2)$ and $(3x^2y + 2x^2y)$. After simplifying this problem to $5xy^2 = 5x^2y$, plug in the value -3 for x and 4 for y, which gives you

$$5(-3)(4)^2 + 5(-3)^2(4) = 5(-3)(16) + 5(9)4$$

$$= -15(16) + 45(4)$$

$$= -240 + 180$$

$$= -60$$

The correct answer is -60, choice **B.**

"Pulling" out Information. "Pulling" information out of the word problem structure can often give you a better look at what you're working with, so you gain additional insight into the problem.

Sample

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8. If a mixture is $\frac{3}{7}$ alcohol by volume and $\frac{4}{7}$ water by volume, what is the ratio of the volume of alcohol to the volume of water in this mixture?

    F. $\frac{3}{7}$

    G. $\frac{4}{7}$

    H. $\frac{3}{4}$

    J. $\frac{4}{3}$

    K. $\frac{7}{4}$

The first bit of information you pull out should be what you're looking for: "ratio of the volume of alcohol to the volume of water." Rewrite it as A:W and then into its working form: $\frac{A}{W}$. Next, you should pull out the volumes of each; $A = \frac{3}{7}$ and $W = \frac{4}{7}$

Now the answer can be easily figured by inspection or substitution. Using

$$\frac{\frac{3}{7}}{\frac{4}{7}}$$

invert the bottom fraction and multiply to get

$$\tfrac{3}{7} \times \tfrac{7}{4} = \tfrac{3}{4}$$

The correct answer is choice **H.** When you pull out information, actually write out the numbers and/or letters to the side of the problem, putting them into some helpful form and eliminating some of the wording.

Substitute Numbers for Variables. Substituting numbers for variables can often help in understanding a problem. Remember to substitute simple numbers, since you have to do the work.

Sample

> **9.** If $x > 1$, which of the following decreases as x decreases?
>
>   I. $x + x^2$
>
>   II. $2x^2 - x$
>
> III. $\dfrac{1}{x + 1}$
>
> **A.** I only
>
> **B.** II only
>
> **C.** III only
>
> **D.** I and II only
>
> **E.** II and III only

First underline or circle "decreases as x decreases." This problem is most easily solved by taking each situation and substituting simple numbers. However, for roman numeral I, $x + x^2$, you should recognize that this expression *will* decrease as x decreases.

Trying $x = 2$ gives

$2 + (2)^2 = 6$

Trying $x = 3$ gives

$3 + (3)^2 = 12$

Notice that choices **B.**, **C.**, and **E.** are already eliminated because they don't contain I. You should also realize that now you need only to try the values in II. (Since III isn't paired with I as a possible choice, III can't be one of the answers.)

Trying $x = 2$ in the expression $2x^2 - x$ gives

$2(2)^2 - 2 = 2(4) - 2$

$= 6$

Trying $x = 3$ gives

$$2(3)^2 - 3 = 2(9) - 3$$
$$= 18 - 3$$
$$= 15$$

This expression also decreases as x decreases. So the correct answer is **D.** Once again, notice that III shouldn't be attempted because it isn't one of the possible choices.

Use 10 or 100. Some problems may deal with percent or percent change. If you don't see a simple method for working the problem, try using values of 10 or 100 and see what you get.

Sample

> **10.** If 40% of the students in a class have blue eyes and 20% of those with blue eyes have brown hair, then what percent of the original total number have brown hair and blue eyes?
>
> **F.** 4%
>
> **G.** 8%
>
> **H.** 16%
>
> **J.** 20%
>
> **K.** 32%

First, underline or circle "percent of the original number . . . brown hair . . . blue eyes." In this problem, if you don't spot a simple method, try starting with 100 students in the class. Since 40% of them have blue eyes, then 40 students have blue eyes. Now, the problem says that 20% of those students with blue eyes have brown hair. So take 20% of 40, which gives

$$.20 \times 40 = 8$$

Since the question asks what percent of the original total number have blue eyes and brown hair, and since you started with 100 students, the answer is choice **G.**, 8 out of 100, or 8%.

Approximate. If it appears that extensive calculations are going to be necessary to solve a problem, check to see how far apart the choices are and then approximate. The reason for checking the answers first is to give you a guide to see how freely you can approximate.

Sample

> **11.** Sam's promotion earns him a new salary that is an increase of 11% over his present salary. If his present salary is $39,400 per year, what is his new salary?
>
>   **A.** $39,411
>
>   **B.** $39,790
>
>   **C.** $43,734
>
>   **D.** $49,309
>
>   **E.** $53,912

First, underline or circle "new salary." Notice that except for the first two choices, the answers are spread out. Approximate 11% as 10% and $39,400 as $40,000. Now, a quick second look tells you that choices **A.** and **B.** aren't sensible because if you add 10% of $40,000, you get $44,000—eliminate choices **A.** and **B.** Choice **C.** is the only answer that's close to $44,000. Since you're allowed to use a calculator on this test, this problem would be easy to check (or work) with the calculator if the answer choices were close together.

Draw a Diagram. Sketching diagrams or simple pictures can also be very helpful in problem solving because the diagram may tip off either a simple solution or a method for solving the problem.

Sample

12. What is the maximum number of pieces of birthday cake 4 inches by 4 inches in size that can be cut from a cake 20 inches by 20 inches?

    F.   5

    G. 10

    H. 16

    J.   20

    K. 25

First, underline or circle "maximum number of pieces." Sketching the cake and marking in as follows makes this a fairly simple problem.
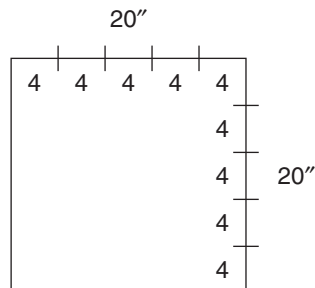
Notice that five pieces of cake will fit along each side. So

$$5 \times 4 = 25$$

The correct answer is **K.** Finding the total area of the cake and dividing it by the area of one of the 4 by 4-inch pieces would also give you the correct answer. But beware of this method because it may not work if the pieces don't fit evenly into the original area.

Sample

13. If points P (1, 1) and Q (1, 0) lie on the same coordinate graph, which of the following must be true?

    I. P and Q are equidistant from the origin.

   II. P is farther from the origin than P is from Q.

  III. Q is farther from the origin than Q is from P.

  A. I only

  B. II only

  C. III only

  D. I and II only

  E. I and III only

First, draw the coordinate graph, and then plot the points as follows.
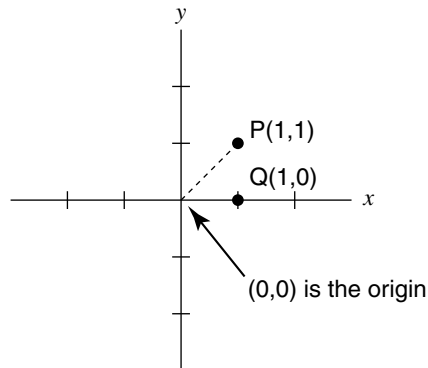
The correct answer is **B.** Only II is true. P is farther from the origin than P is from Q.

Mark in Diagrams. Marking in diagrams as you read them can save you valuable time. Marking can also give you insight into how to solve a problem because you'll have the complete picture clearly in front of you.
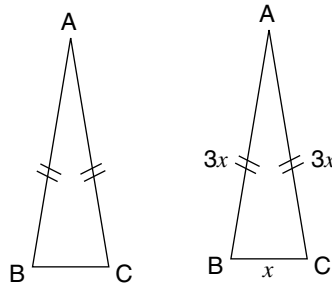
Sample

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14. The perimeter of the isosceles triangle shown below is 42. The two equal sides, $\overline{AB}$ and $\overline{AC}$ are each three times as long as the third side. What are the lengths of each side?

F. 21, 21, 21

G. 6, 6, 18

H. 18, 21, 3

J. 18, 18, 6

K. 4, 19, 19
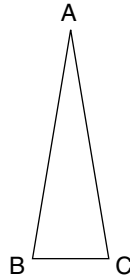
Mark the equal sides on the diagram. $\overline{AB}$ and $\overline{AC}$ are each three times as long as $\overline{BC}$.
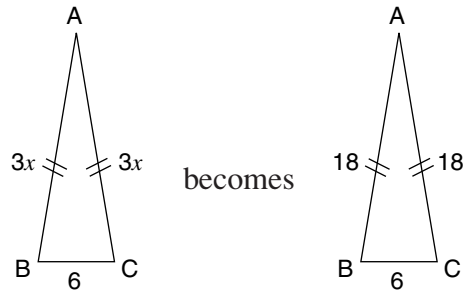
The equation for perimeter is

$$3x + 3x + x = 42$$
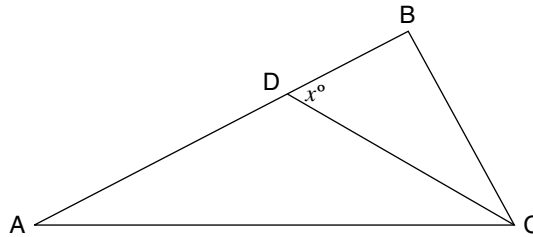
$$7x = 42$$

$$x = 6$$

The answer is **J.** Note that this problem could also be solved by working from the answers given.

Sample

15. In the triangle shown below, $\overline{CD}$ is an angle bisector, $\angle ACD$ is 30° and $\angle ABC$ is a right angle. What is the measurement of $\angle x$ in degrees?

   A. 30°

   B. 45°

   C. 60°

   D. 75°

   E. 80°

First, underline or circle "measurement of $\angle x$." You should read the problem and mark as follows.

In the triangle shown below, *CD* is an angle bisector (**stop and mark in the drawing**), $\angle ACD$ is 30° and $\angle ABC$ is a right angle (**stop and mark in the drawing**). What is the measurement of $\angle x$ in degrees? (**stop and mark in or circle what you're looking for in the drawing**)
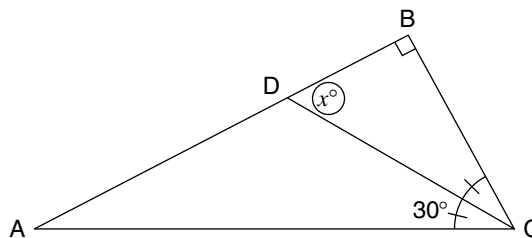
Now, with the drawing marked in, it's evident that since ∠ACD is 30°, then ∠BCD is also 30°, because they are formed by an angle bisector (divides an angle into two equal parts). Since ∠ABC is 90° (a right angle) and ∠BCD is 30°, then ∠x is 60° because there are 180° in a triangle.

$$180 - (90 + 30) = 60$$

The correct answer is **C.** *Always mark in diagrams as you read their descriptions and information about them, including what you're looking for.*

Glance at the Answer Choices on Procedure Problems. Some problems may not ask you to solve for a numerical answer or even an answer including variables. Rather, you may be asked to set up the equation or expression without doing any solving. A quick glance at the answer choices will help you know what is expected.

Sample

16. Uli was 12 years old x years ago. In 8 years, how old will she be?

    F. $20 - x$

    G. $(12 + x) + 8$

    H. $(12 - x) + 8$

    J. $(8 + x) - 12$

    K. $(12 + 8) - x$

First, underline or circle "In 8 years, how old." Next, glance at the answers. Notice that none of them gives an actual numerical answer, but rather, each sets up a way to find the answer. Now set up the problem.

"12 years old x years ago" can be written as

$$12 + x$$

"In 8 years" tells you to add 8 more, so the answer is

$$(12 + x) + 8$$

which is choice **G.**

Use Your Calculator. Some questions will need to be completely worked out. If you don't see a fast method but do know that you could compute the answer, use your calculator.

Sample

17. What is the final cost of a watch that sells for $49.00 if the sales tax is 7%?

    A. $49.07

    B. $49.70

    C. $52.00

    D. $52.43

    E. $56.00

The correct answer is **D.** First, underline or circle "final cost." Since the sales tax is 7% of $49.00,

$$7\% \text{ of } \$49.00 \ = (.07)\,(\$49.00)$$

$$= \$3.43$$

The total cost of the watch is therefore

$$\$49.00 + \$3.43 = \$52.43$$

Your calculator can be helpful with such calculations.