

CALCULATOR EXERCISE

The purpose of this exercise is to emphasize to students the appropriate use of a calculator on the exam. The exercise asks the students to place the items into one of three categories:

Category 1: A calculator would be very useful (it would save valuable test time).

Category 2: A calculator might or might not be useful.

Category 3: A calculator would be counterproductive (it would waste valuable test time).

The calculator is not a substitute for problem-solving strategies. Rather, it is a useful tool only in situations where straight mathematical computations are needed and it would be faster to use a calculator than to do the computation by hand.

Some of these items will be covered again later in the Math Lessons. However, the explanations here have been modified to note when a calculator might be useful.

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This exercise is designed to illustrate when and when not to use your calculator. Make sure that the calculator you bring to the ACT test is one with which you are thoroughly familiar. (For more detailed information on calculator usage, including specific models that are prohibited on the test, go to <http://www.actstudent.org>.) Although no item requires the use of a calculator, a calculator may be helpful at times. It may be useful for any item that involves complex arithmetic computations, but it cannot take the place of understanding how to set up a mathematical item. The degree to which you can use your calculator will depend on its features. Answers are on page 438.

DIRECTIONS: Label each of the items that follow according to one of the following categories. Then solve each item.

Category 1: A calculator would be very useful (it would save valuable test time).

Category 2: A calculator might or might not be useful.

Category 3: A calculator would be counterproductive (it would waste valuable test time).

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1. What is the average of 8.5, 7.8, and 7.7?
- A. 8.3
B. 8.2
C. 8.1
D. 8.0
E. 7.9
2. If $0 < x < 1$, which of the following has the greatest value?
- F. x
G. $2x$
H. x^2
J. x^3
K. $x + 1$

EXPLANATIONS

1. **(D)** (Category 1) *Mathematics/Statistics and Probability/Measures of Center*
CC: 6.SP.B.5c CCRS: BSC.SP.1

To find the average of the three numbers, simply total the numbers and divide the sum by 3: $\frac{8.5 + 7.8 + 7.7}{3}$ **(calculator)** = $\frac{24.0}{3} = 8.0$.

2. **(K)** (Category 2) *Mathematics/Number and Quantity/Properties of Numbers*
CC: 5.NF.B.6 CCRS: AVG.NS.1

Because $0 < x$, x is positive, and because $x < 1$, x must be a fraction. When a positive fraction is raised to a power, the result is less than the original fraction, so (H) and (J) are less than (F). However, (G) is double the value of (F), so (G) is greater. Finally, (K) is greater than (G): $2x$ is equal to $x + x$, and since x is a fraction, (K) must be greater than (G).

Alternatively, if unable to remember the principles of positive and negative numbers and fractions, substitute sample values for x and plug these values into each answer choice. Select the answer that returns the greatest value **(calculator)**.

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3. If 4.5 pounds of chocolate cost \$10, how many pounds of chocolate can be purchased for \$12?

- A. $4\frac{3}{4}$
- B. $5\frac{2}{5}$
- C. $5\frac{1}{2}$
- D. $5\frac{3}{4}$
- E. 6

4. What is the value of $\frac{8}{9} - \frac{7}{8}$?

- F. $\frac{1}{72}$
- G. $\frac{1}{8}$
- H. $\frac{1}{7}$
- J. $\frac{15}{72}$
- K. $\frac{15}{7}$

5. Which of the following fractions has the greatest value?

- A. $\frac{111}{221}$
- B. $\frac{75}{151}$
- C. $\frac{333}{998}$
- D. $\frac{113}{225}$
- E. $\frac{101}{301}$

EXPLANATIONS

3. (B) (Category 2) *Mathematics/Number and Quantity/Rates and Proportions*
CC: 6.RP.A.3b CCRS: AVG.AF.1

Since \$10 buys $4\frac{1}{2}$ pounds of chocolate, the cost per pound is $\$10 \div 4\frac{1}{2} = \$2\frac{2}{9}$

(a fraction is used to avoid the repeating decimal 2.222...). Next, divide:

$$12 \div 2\frac{2}{9} = 5\frac{2}{5}.$$

The same result can be achieved more easily by using a proportion:

$$\frac{\text{Amount } x}{\text{Amount } y} = \frac{\text{Cost } x}{\text{Cost } y}. \text{ Plug the given}$$

values into the proportion and solve for

$$x: \frac{4.5}{x} = \frac{10}{12} = \text{(calculator)} \Rightarrow 54 = 10x \Rightarrow x = 5\frac{2}{5} \text{ (calculator).}$$

4. (F) (Category 3) *Mathematics/Number and Quantity/Basic Arithmetic Manipulations*
CC: 5.NF.A.1 CCRS: BSC.AF.1

The arithmetic is so simple that you should not hesitate to perform the subtraction indicated:

$$\frac{8}{9} - \frac{7}{8} = \frac{64 - 63}{72} = \frac{1}{72}.$$

If your **calculator** handles fractions, type in $8 \div 9 - 7 \div 8$ and convert the result to fractional form. This method would change this item to **Category 1**.

5. (A) (Category 1) *Mathematics/Number and Quantity/Properties of Numbers*
CC: 6.NS.C.7b CCRS: AVG+.NS.1

Each answer choice can be converted to a decimal via simple division with a **calculator**.

Alternatively, approximate. (A), (B), and (D) are all very close to $\frac{1}{2}$ (their denominators are about twice their numerators); (C) and (E) are closer to $\frac{1}{3}$. Since $\frac{1}{3} < \frac{1}{2}$, eliminate (C) and (E). Take a

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6. Dr. Leo's new office is 2.8 yards by 4 yards. She plans to run a decorative border around the perimeter of the office. How many yards of wallpaper border should she purchase?

F. 8.0
 G. 13.2
H. 13.6
 J. 14.2
 K. 16.7

7. What is the value of $\frac{2}{3} - \frac{5}{8}$?

A. 1
 B. $\frac{15}{16}$
 C. $\frac{3}{24}$
D. $\frac{1}{24}$
 E. $\frac{1}{100}$

EXPLANATIONS

closer look at the remaining choices.

(A) and (D) are both slightly more than $\frac{1}{2}$ (their denominators are a little less than twice their numerators). However, (B) is slightly less than $\frac{1}{2}$ (the denominator is slightly more than twice the numerator). Thus, eliminate (B). Now the choice is between (A), $\frac{111}{221}$, and (D), $\frac{113}{225}$. Since $\frac{1}{221}$ is larger than $\frac{1}{225}$, (A) is slightly larger than (D), and (A) is the answer.

6. **(H) (Category 1) Mathematics/Geometry/Rectangles and Squares**
 CC: 4.MD.A.3 CCRS: AVG.G.3

Find the perimeter of the office:

$$2.8 + 2.8 + 4 + 4 = 13.6 \text{ (calculator).}$$

7. **(D) (Category 3) Mathematics/Number and Quantity/Basic Arithmetic Manipulations**
 CC: 5.NF.A.1 CCRS: BSC.AF.1

Use the lowest common denominator to combine the fractions:

$$\frac{2}{3} - \frac{5}{8} = \frac{16 - 15}{24} = \frac{1}{24}. \text{ Note that a}$$

calculator is not very useful here.

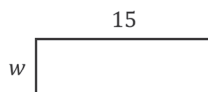
However, if your **calculator** handles fractions, type in $2 \div 3 - 5 \div 8$ and convert to fractional form, making this item **Category 1**.

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8. If $3x + y = 33$ and $x + y = 17$, then what is the value of x ?

- F. 8
- G. 12
- H. 16
- J. 24
- K. 33

9. If the perimeter of the rectangle below is 40, what is its area?



- A. 5
 - B. 15
 - C. 25
 - D. 45
 - E. 75
10. If the price of a book increases from \$10.00 to \$12.50, what is the percent increase in price?

- F. 2.5%
- G. 12.5%
- H. 25%
- J. 33%
- K. 50%

EXPLANATIONS

8. (F) (Category 3) *Mathematics/Algebra and Functions/Solving Simultaneous Equations*

CC: 8.EE.C.8b CCRS: ADV.A.4

Define y in terms of x : $x + y = 17$, so $y = 17 - x$. Substitute this new definition for y into the other equation: $3x + y = 33 \Rightarrow 3x + (17 - x) = 33 \Rightarrow 2x + 17 = 33 \Rightarrow 2x = 16 \Rightarrow x = 8$. Be sure that you solve for the correct variable.

An easier method is to subtract one equation from the other and eliminate one of the variables:

$$\begin{array}{r} 3x + y = 33 \\ - (x + y = 17) \\ \hline 2x = 16 \\ x = 8 \end{array}$$

9. (E) (Category 3) *Mathematics/Geometry/Rectangles and Squares*

CC: 7.EE.B.4a CCRS: AVG+.G.6

The perimeter is $2w + 2l = 2w + 2(15) = 40 \Rightarrow 2w = 10 \Rightarrow w = 5$. Find the area by multiplying the length by the width: $(15)(5) = 75$. The easy math eliminates the need for a **calculator**.

10. (H) (Category 3) *Mathematics/Number and Quantity/Percentages*

CC: 7.RP.A.3 CCRS: AVG.AF.1

Determine the difference in prices: $\$12.50 - \$10.00 = \$2.50$. (The easy math eliminates the need for a **calculator**.) And \$2.50 is what percentage of \$10.00? The answer is 25.