Calculator Exercise

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

Category 1: A calculator would be very useful (saves valuable test time).
Category 2: A calculator might or might not be useful.
Category 3: A calculator would be counterproductive (wastes 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: Multiple-Choice lessons. However, the explanations here have been modified to note where a calculator might be useful.

(Student Text, p. 251)

This exercise is designed to illustrate when and when not to use your calculator. Make sure that the calculator you bring to the test is one with which you are thoroughly familiar. You may bring any of the following types of calculators: graphing, four-function, or scientific. Although no item requires the use of a calculator, a calculator may be helpful to answer some items. The calculator 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 529.

(Student Text, p. 251)

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

Category 1: A calculator would be very useful (saves valuable test time).
Category 2: A calculator might or might not be useful.
Category 3: A calculator would be counterproductive (wastes valuable test time).

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

1. **(D) (Category 1)** ***Math: Multiple-Choice/ Statistics/Measures of Center and Spread/Averages***

SAT Topic: PSD.9; CC: 6.SP.B.5c

No original thinking is needed to solve this item. 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)** $=\frac{24.0}{3}=8.0$**.**

Thus, the answer is (D).

(Student Text, p. 251)

2. If $0<x<1$, which of the following is the largest?

A) $2x$
B) x^2
C) x^3
D) $\boldsymbol{x+1}$

2. (D) (Category 2) ***Math: Multiple-Choice/ Problem Solving and Advanced Arithmetic/Common Advanced Arithmetic Items/Properties of Numbers***

SAT Topic: ALG.2; CC: 5.NF.B.6

The item states that x is positive; when a positive fraction is raised to a power, the result is smaller than the original fraction, so (B) and (C) are less than the value of x. However, (A) is $2x$, so (A) is larger than (B) and (C). Finally, (D) is larger than (A): $2x$ is equal to $x + x$, and since $1 > x$, (D) must be larger than (A). Alternatively, if you are unable to remember the principles of positive and negative numbers, plug in numbers **(calculator)**.

(Student Text, p. 251)

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) $\mathbf{5\frac{2}{5}}$

C) $5\frac{1}{2}$

D) $5\frac{3}{4}$

3. (B) (Category 2) ***Math: Multiple-Choice/ Problem Solving and Advanced Arithmetic/Common Problem Solving Items/ Proportions and Direct-Inverse Variation***

SAT Topic: PSD.1; CC: 6.RP.A.3b

\$10 buys $4\frac{1}{2}$ pounds of chocolate, so 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: $12 \div 2\frac{2}{9} = 5\frac{2}{5}$. (B) is the answer. The same result can be achieved more easily by using a proportion: $\frac{\text{Amount } x}{\text{Amount } y} = \frac{\text{Cost } x}{\text{Cost } y}$. Plug the given values into the proportion and solve for x: $\frac{4.5}{x} = \frac{10}{12} =$ **(calculator)** $\Rightarrow$ $54 = 10x \Rightarrow x = 5\frac{2}{5}$ **(calculator)**.

(Student Text, p. 251)

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

A) $\mathbf{\frac{1}{72}}$

B) $\frac{1}{8}$

C) $\frac{1}{7}$

D) $\frac{15}{72}$

4. (A) (Category 3) ***Math: Multiple-Choice/ Problem Solving and Advanced Arithmetic/ Common Advanced Arithmetic Items/ Properties of Numbers***

SAT Topic: PAM.9; CC: 5.NF.A.1

The arithmetic is so simple that you should not hesitate to perform the subtraction indicated: $\frac{8}{9} - \frac{7}{8} = \frac{64 - 63}{72} = \frac{1}{72}$, (A). (If your **calculator** handles fractions, type in $8 \div 9 - 7 \div 8$ and convert to fractional form, making this item Category 1.)

(Student Text, p. 251)

5. Which of the following fractions is the largest?

A) $\mathbf{\frac{111}{221}}$

B) $\frac{75}{151}$

C) $\frac{333}{998}$

D) $\frac{113}{225}$

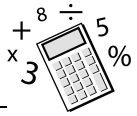
5. (A) (Category 2) ***Math: Multiple-Choice/ Problem Solving and Advanced Arithmetic/ Common Advanced Arithmetic Items/ Properties of Numbers***

SAT Topic: PAM.2; CC: 6.NS.C.7b

The process of comparing fractions by converting them to decimals would obviously be time-consuming if done by hand (this item can be solved quickly with a **calculator**), so there must be an alternative: approximation. (A), (B), and (D) are all very close to $\frac{1}{2}$ (their denominators are about twice their numerators); (C) is closer to $\frac{1}{3}$. Since $\frac{1}{3} < \frac{1}{2}$, eliminate (C). Take a 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), $\frac{113}{225}$. Use a calculator to covert the fractions to decimals and compare the two values: $\frac{111}{221} = 0.50226$ and $\frac{113}{225} = 0.50\overline{2}$, so (A) is larger.

Finally, if you have time and think your class might enjoy the exercise, you can administer the "Calculator Race" included at the end of this section. The "Calculator Race" isn't included in the student text, so you'll need to copy and distribute it. The objective is to demonstrate that a calculator is a help when properly used but a hindrance when improperly used. Divide the class into two groups: those with calculators and those without. Announce "START" and wait to see which group finishes first. Even if the "no calculator" group doesn't win, they won't be far behind, illustrating that it is often faster and easier to solve items without a calculator. If you have time, review the explanations that follow the "Calculator Race" at the end of this section.

Calculator Race



1. Reena used $2\frac{2}{7}$ gallons of gasoline on Monday and $1\frac{1}{3}$ on Tuesday. How much gasoline did she use on those two days?

A) $3\frac{3}{21}$
B) $3\frac{3}{10}$
C) $3\frac{13}{21}$
D) $3\frac{15}{21}$

2. A rectangular lot that measures 250 feet by 300 feet is completely fenced. What is the approximate length of the fence, in feet?

A) 550
B) 750
C) 1,100
D) 1,500

3. If 12 roses cost $18.00, what is the cost of 1 rose?

A) $0.67
B) $1.34
C) $1.50
D) $3.00

4. In a survey of 61 people, 39 responded that they had seen a certain movie. What percentage, to the nearest percent, of the people had seen the movie?

A) 22%
B) 39%
C) 45%
D) 64%

5. What is the value of $|-4|-|5-12|$?

A) –3
B) 3
C) 11
D) 22

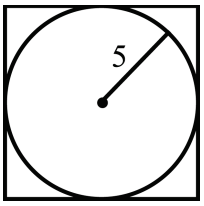
6. The formula for converting temperature readings in degrees Fahrenheit, *F*, into degrees Celsius, *C*, is $F=\left(\frac{9}{5}\right)C+32$. If the reading on a Celsius thermometer is 34°, what is the equivalent temperature, to the nearest degree, on a Fahrenheit thermometer?

A) 18°
B) 52°
C) 66°
D) 93°

7. Natalie rode her bicycle 3.1 miles in 20 minutes. What was her speed in miles per hour?

A) 3.1
B) 9.3
C) 16.9
D) 60.1

8. In the figure below, a circle with radius 5 is inscribed in a square. What is the area of the square?



A) 25
B) 10π
C) 25π
D) 100

9. A box contains 12 ounces of plastic fasteners. If each fastener weighs 0.03 ounces, how many fasteners does the box contain?

A) 40
B) 90
C) 150
D) 400

10. If $x^2 = 81$ and $y^2 = 49$, which of the following can be the value of $x + y$?

A) -16
B) -4
C) 1
D) 9

Answers and Explanations

1. (C) ***Math: Multiple-Choice/Problem Solving and Advanced Arithmetic/Multi-Step Problem Solving Items***

SAT Topic: PSD.1; CC: 5.NF.A.1

Manipulate the fractions: $2\frac{2}{7}+1\frac{1}{3}=$ $2\frac{6}{21}+1\frac{7}{21}=3\frac{6+7}{21}=3\frac{13}{21}$, (C).

Contrast this with the calculator method. First, convert the total gasoline used on Monday and Tuesday to decimals: $2\frac{2}{7}\approx 2+0.29=2.29,$ and $1\frac{1}{3}\approx 1+0.33=1.33$. Then add: $2.29+1.33=$ 3.62. Now, convert the answer choices to fractions. After converting, it is easy to see that (C) is the correct answer choice. Note that having to convert the fractions in the answer choices makes the calculator an inefficient tool for solving this item (unless the calculator includes a "FRAC" key).

2. (C) ***Math: Multiple-Choice/Geometry/ Rectangles and Squares***

SAT Topic: PSD.1; CC: 4.MD.A.3

The dimensions are 250, 250, 300, and 300, which quickly adds to $500+600=1{,}100$. Doing the calculation in your head is faster than pushing the buttons on a calculator.

3. (C) ***Math: Multiple-Choice/Problem Solving and Advanced Arithmetic/Common Problem Solving Items/Ratios***

SAT Topic: PSD.1; CC: 6.RP.A.3b

This is another problem easily solved in your head: $\frac{\$18}{12}=\frac{\$3}{2}=\$1.50$ per rose.

4. (D) ***Math: Multiple-Choice/Problem Solving and Advanced Arithmetic/Common Problem Solving Items/Percentages***

SAT Topic: PSD.2; CC: 6.RP.A.3c

This item can be solved using a calculator, but it is simple enough to solve by hand: the fraction $\frac{39}{61}$ is very close to $\frac{40}{60}=\frac{2}{3}$, or $66\frac{2}{3}\%$. Therefore, the correct answer is (D), 64%.

5. (A) ***Math: Multiple-Choice/Problem Solving and Advanced Arithmetic/Common Advanced Arithmetic Items/Absolute Value***

SAT Topic: PSD.1; CC: 7.NS.A.1c

Again, it is faster to perform the calculations by hand: $|-4|-|5-12|=4-|-7|=\ 4-7=-3$.

6. (D) ***Math: Multiple-Choice/Algebra/Creating, Expressing, and Evaluating Algebraic Equations and Functions/Functions as Models***

SAT Topic: ALG.1; CC: 6.EE.A.2c

This problem too can be efficiently attacked without a calculator: $F=\frac{9}{5}(34)+32$. If the 34 were 35, then it would be possible to simplify the equation: $F=\frac{9}{5}(35)+32=(9)(7)+32=$ $63+32=95°$. So, the actual value is just a tad less than 95°, making 93° the correct answer.

7. (B) ***Math: Multiple-Choice/Problem Solving and Advanced Arithmetic/Common Problem Solving Items/Proportions and Direct-Inverse Variation***

SAT Topic: PSD.1; CC: 6.RP.A.3d

A calculator isn't necessary: $\frac{3.1 \text{ miles}}{20 \text{ minutes}}=$ $\frac{3.1 \text{ miles}}{\frac{1}{3} \text{ hour}}=(3.1)(3)=9.3$ miles per hour.

8. (D) ***Math: Multiple-Choice/Geometry/Rectangles and Squares*** **and** ***Circles***

SAT Topic: ATM.5; CC: 7.G.B.6

Again, it's faster to do the mental calculations. The radius of the circle is 5, so the diameter is 10, and the diameter is equal to the side of the square. The area of the square is $10 \cdot 10 = 100$.

9. (D) ***Math: Multiple-Choice/Problem Solving and Advanced Arithmetic/Common Problem Solving Items/Proportions and Direct-Inverse Variation***

SAT Topic: PSD.1; CC: 6.RP.A.3b

Set up a direct proportion: $\frac{1 \text{ fastener}}{0.03 \text{ ounces}} = \frac{x \text{ fasteners}}{12 \text{ ounces}}$. Now, solve for x: $x = \frac{12 \cdot 1}{0.03} = 400$ fasteners. Again, this calculation is simple enough to do in your head.

10. (A) ***Math: Multiple-Choice/Algebra/Solving Quadratic Equations and Relations***

SAT Topic: PAM.5; CC: 8.EE.A.2

On this item, using a calculator could actually get you into trouble. A calculator will indicate that the square root of 81 is 9 and the square root of 49 is 7, which means that a possible value for $x + y$ is 16—not one of the answer choices. Of course, other possible values are -9 and -7, which total -16, or -9 and 7, which total -2, or 9 and -7, which total 2. Only (A) offers one of these choices: -16.