# SAT Math Facts & Formulas Review Quiz

Test your knowledge of SAT math facts, formulas, and vocabulary with the following quiz. Some questions are more challenging, just like a few of the questions that you'll encounter on the SAT; these questions are denoted with the symbol: ☹. When you answer one of these questions correctly, celebrate a little: do a dance, throw your hands in the air and yell, "Yes!", and collect your monetary prize. Well, perhaps not that last one. Good luck!

## *Numbers and Operations*

**1.** What is eight more than twice the greatest negative integer?

(A) 6
(B) 7
(C) 8
(D) 9
(E) 10

**2.** Which of the following is true?

(A) Zero is not even and not positive.
(B) Zero is even and positive.
(C) The largest factor of 28 is 14.
(D) The sum of the smallest prime and the greatest negative even integer is zero.
(E) The positive numbers are all happy and think nothing of zero.

**3.** What is the sum of the smallest prime and the largest prime less than 10?

(A) 8
(B) 9
(C) 10
(D) 11
(E) 12

**4.** How many even integers are between $-10$ and 10?

(A) 7
(B) 8
(C) 9
(D) 10
(E) 11

**5.** What are the factors of the number 28?

**6.** What number do you get when you multiply the *distinct* prime factors of 56?

(A) 4
(B) 7
(C) 14
(D) 28
(E) 56

$$3 \cdot 2^{279841} - 1$$

**7.** Is the value of the above expression even or odd?

**8.** Set $P$ is the set of all positive multiples of 4 less than 30. Set $Q$ is the set of all positive multiples of 6 less than 30. How many numbers are in the intersection of sets $P$ and $Q$?

(A) 0
(B) 1
(C) 2
(D) 3
(E) 4

**9.** How many odd integers are between $-20/3$ and $51/4$?

(A) 6
(B) 7
(C) 8
(D) 9
(E) 10

**10.** The number 9 is what percent of the number 72 ?

(A) 8%
(B) 9.5%
(C) 11.5%
(D) 12%
(E) 12.5%

**11.** The price of a shirt is increased by 20%, and the price of a \$40 pair of shoes is decreased by 40%. If the new price of the shirt now equals the new price of the shoes, what was the original price of the shirt?

(A) \$16
(B) \$20
(C) \$24
(D) \$28
(E) \$32

4, 9, 14, 19, 24, ...

**12.** In the list above, the first term is 4 and each term thereafter is 5 more than the previous term. What is the difference between the $5790^{\text{th}}$ term and the $5795^{\text{th}}$ term?

(A) 5
(B) 15
(C) 20
(D) 25
(E) 30

**13.** What is the value of the expression $12 \div 3 + 3 \times (6 - 7)^{314159}$ ?

(A) $-2$
(B) $-1$
(C) 1
(D) 5
(E) 7

**14.** What is the sum of all the odd positive integers less than 100? ☹

(A) 2400
(B) 2500
(C) 2525
(D) 2600
(E) 2650

**15.** A particular fraction is equivalent to 1/2. If 3 is added to the numerator, and 4 is added to the denominator, the fraction becomes equivalent to 3/5. What was the denominator of the original fraction? ☹

(A) 2
(B) 3
(C) 4
(D) 6
(E) 8

**16.** What is the result of multiplying the greatest common factor of 30 and 102 by the least common multiple of 12 and 15?

**17.** The price of an heirloom cabbage is decreased by 10% from its original price. Some time later, the price is then increased by 10% from its reduced price. What is the ratio of the final price to the original price? ☹

# SAT Math Facts & Formulas Review Quiz

## *Algebra and Functions*

**1.** Twelve more than twice a certain number is six fewer than three times the number. What is the number?

(A) 6
(B) 12
(C) 16
(D) 18
(E) 24

**2.** If $x^2 + 5x - 14 = 0$, and $x > 0$, then what is the value of $x$?

(A) $-7$
(B) 1
(C) 2
(D) 4
(E) 6

**3.** If $(2^2)^x = 64$, then what is the value of $x$?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 6

**4.** If $5^n \div 5^3 = 5^7$, then what is the value of $n$?

(A) 3
(B) 4
(C) 5
(D) 7
(E) 10

**5.** Which of the following is equivalent to $121 - x^2$ ?

(A) $(11 - x)^2$
(B) $(11 - x)x$
(C) $(11 - x)(11 - x)$
(D) $(11 - x)(11 + x)$
(E) $(121 + x)(1 - x)$

**6.** If $f(x) = \sqrt{x}$, then what is the smallest number in the domain of the function $f$ ?

**7.** If $f(x) = 1 - x^2$, then what is the largest number in the range of the function $f$ ?

**8.** If $g(x) = 2x - 3$, then what is the value of $g(2) - g(3)$ ?

(A) $-2$
(B) $-1$
(C) $2$
(D) $3$
(E) $4$

**9.** If $f(x) = 2x^2$, and $2f(3a) = 144$, then what could be the value of $a$ ?

(A) $-3$
(B) $-1$
(C) $1$
(D) $2$
(E) $\sqrt{8}$

**10.** A candy supply company sells chocolate-dipped cabbages, priced according to how much each cabbage weighs. The first seven ounces cost 25 cents each, and each additional ounce costs 15 cents. If $p(c)$ is the price *in dollars* of a cabbage weighing $c$ ounces, with $c \geq 7$, then which of the following is $p(c)$ ? ☹

(A) $p(c) = 175 + 15c$
(B) $p(c) = .25 + .15c$
(C) $p(c) = .25 + .15(c - 7)$
(D) $p(c) = 1.75 + .15(c - 7)$
(E) $p(c) = 1.75 + .15c$

**11.** For any two integers $a$ and $b$, let $a \nabla b = 2a + 3b$. What is the value of $3 \nabla 2$ ?

(A) $1 \nabla 5$
(B) $2 \nabla 3$
(C) $4 \nabla 1$
(D) $5 \nabla 2$
(E) $6 \nabla 0$

$$x + \frac{7}{x} = 8$$

**12.** If $x > 1$ and $x$ satisfies the equation above, what is the value of $x$ ?

$$x^{-\frac{1}{2}} = \frac{1}{16}$$

**13.** What is the value of $x$ in the equation above? ☹

# SAT Math Facts & Formulas Review Quiz

## *Geometry*

**1.** The area of a circle is $81\pi$. What is the circumference of the circle?

(A) $9\pi$
(B) $12\pi$
(C) $18\pi$
(D) $24\pi$
(E) $36\pi$

**2.** The ratio of the circumference of a circle to twice the diameter of the circle is which of the following?

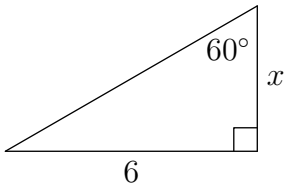
(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{2}$

(C) $\pi$

(D) $2\pi$

(E) $4\pi$

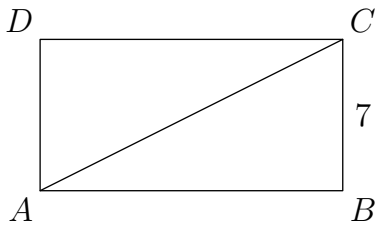



**3.** In the triangle in the figure above, what is the value of $x$ ?

(A) $2\sqrt{3}$
(B) $6\sqrt{2}$
(C) $6\sqrt{3}$
(D) 6
(E) 12

**4.** Triangle $ABC$ has two legs of lengths 6 ($AB$) and 8 ($AC$). If the degree measure of angle $\angle BAC$ is 90°, then which of the following is the length of the third side ($BC$)?

(A) 4
(B) 6
(C) 8
(D) 10
(E) 12




**5.** The area of rectangle $ABCD$ above is 168. What is the length of segment $\overline{AC}$?

(A) $7\sqrt{2}$
(B) 14
(C) 21
(D) 24
(E) 25

**6.** Two sides of a triangle have lengths 7 and 9. Which of the following could *not* be the length of the third side?

(A) 3
(B) 5
(C) 7
(D) 11
(E) 16

**7.** Two sides of a triangle have lengths 5 and 8, and the length of the third side is an integer. What is the greatest possible value of the perimeter of the triangle?

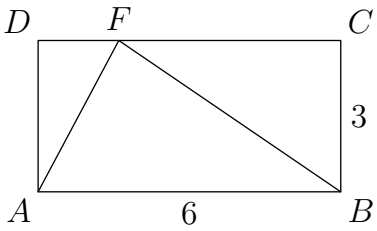
(A) 23
(B) 24
(C) 25
(D) 26
(E) 27

**8.** A line goes through the points $(1, 2)$ and $(5, 10)$. Which of the following is the equation of the line?

(A) $y = 4x - 2$
(B) $y = 2x$
(C) $y = 3x - 1$
(D) $y = x + 5$
(E) $y = 3x - 5$

**9.** The line $l$ goes through the points $(1, 2)$ and $(5, 10)$. Which of the following could be the equation of a line perpendicular to $l$?

(A) $4x + 2y = 6$
(B) $2x - y = 0$
(C) $x + y = 3$
(D) $x + 2y = 6$
(E) $x - 2y = 5$




**10.** In the figure above, $ABCD$ is a rectangle. What is the area of triangle $AFB$? ☹

**11.** The radius of right cylinder $A$ is twice the radius of right cylinder $B$, and the height of cylinder $B$ is twice the height of cylinder $A$. What is the ratio of the volume of cylinder $A$ to the volume of cylinder $B$? ☹

# SAT Math Facts & Formulas Review Quiz

## *Data, Statistics, and Probability*

**1.** If the average of 3, 4, and $x$ is $-2$, then what is the value of $x$?

(A) $-15$
(B) $-13$
(C) $-8$
(D) $-6$
(E) $-2$

**2.** If the average of five numbers is 10, and the fifth number is 6, then what is the average of the first four numbers?

(A) 9
(B) 10
(C) 11
(D) 12
(E) 13

**3.** Set $M$ consists of all the integers from $-15$ to 15, inclusive. If a number is drawn at random from set $M$, then what is the probability that the number is a multiple of 3?

(A) $\frac{11}{31}$
(B) $\frac{10}{31}$
(C) $\frac{5}{10}$
(D) $\frac{4}{15}$
(E) $\frac{1}{3}$

**4.** If $x$ and $y$ are positive integers, $y > x$, and the average (arithmetic mean) of $x$ and $y$ is 100, then which of the following is the greatest possible value of $y$?

(A) 150
(B) 198
(C) 199
(D) 200
(E) 201

**5.** A twelve-sided die has the numbers one through twelve on the faces of the die. When the die is rolled, what is the probability that the number on top is an odd number?

(A) $\frac{1}{6}$

(B) $\frac{1}{5}$

(C) $\frac{1}{4}$

(D) $\frac{1}{3}$

(E) $\frac{1}{2}$

15, 9, 27, 10, 14, 9, 20

**6.** The number 10 is to be added to the list above. Which of the following must be true about the median and mode of the new list compared to the original?

(A) The median and the number of modes will not change.
(B) The number of modes will increase and the median will decrease.
(C) The number of modes will increase and the median will increase.
(D) The number of modes will decrease and the median will decrease.
(E) The mode will tell the median to give it a Twinkie.

**7.** A vat contains 15 cabbages, 20 carrots, and 25 turnips. If a single vegetable is picked at random from the vat, what is the probability that it will *not* be a carrot?

# SAT Math Facts & Formulas Review Quiz

## Answers

### *Numbers and Operations*

**1.** A

Since the greatest negative integer is $-1$, the answer is $2(-1) + 8 = 6$.

**2.** D

The smallest prime is 2 and the greatest negative even integer is $-2$, so answer D is correct.

Why are the other choices false? Zero is an even integer, since it can be divided by two without any remainder. Also, zero is neither positive nor negative: it is the integer that divides the number line into negative on the left and positive on the right. The largest factor of 28 is 28 itself. As for answer E, everyone knows that even the positive numbers are unhappy from time to time.

**3.** B

The smallest prime number is 2, and the largest prime number less than 10 is 7, so the answer is $2 + 7 = 9$.

**4.** C

Remember that "between" means that you should *not* include the end points. So, the even integers between $-10$ and 10 are $-8$, $-6$, $-4$, $-2$, 0, 2, 4, 6, and 8.

**5.** 1, 2, 4, 7, 14, and 28

To determine all the factors of a number, first write a 1 on the left and then the desired number to factor on the right with space in between. Just to the right of the 1, write the next smallest integer that goes into the desired number without a remainder (in this case, 2). Divide the desired number by that integer, and write the result (here, 14) on the right next to the number. Continue in this way until the numbers meet in the middle.

**6.** C

You should use a *factor tree* to determine all the prime factors of 56, which are 2, 2, 2, and 7 ($56 = 2 \times 2 \times 2 \times 7$). Here, the word *distinct* means "different" or "unique". So, the distinct prime factors of 56 are 2 and 7 so that $2 \times 7 = 14$.

**7.** odd

First, note that 2 raised to any integer power is still an even number, since it can be divided by two without a remainder. When 2 raised to an integer power is multiplied by three, it can *still* be divided by two, so $3 \cdot 2^{279841}$ is even. Finally, subtracting 1 makes an even number into an odd number.

**8.** C

The positive multiples of 4 less than 30 are 4, 8, 12, 16, 20, 24, and 28, and the positive multiples of 6 less than 30 are 6, 12, 18, and 24, so the intersection of these two sets is the set consisting of the numbers 12 and 24.

**9.** D

Since $-20/3 = -6\frac{2}{3}$ and $51/4 = 12\frac{3}{4}$, the odd integers that we need to count are $-5$, $-3$, $-1$, 1, 3, 5, 7, 9 and 11, so the answer is 9. It may be helpful to visualize or write down the number line for this question. Note that $-7$ is *less* than (to the left of) $-20/3$, so it isn't between the two numbers in this problem.

**10.** E

Convert these words into an equation that you can solve, using a variable (such as $x$) for the desired quantity (in this case, the "what"). Remembering that $x$ percent is the same as $x/100$, the equation is:

$$9 = \frac{x}{100} \cdot 72.$$

Solving this equation for $x$ (your calculator may be helpful here) gives the answer.

**11.** B

First, determine the new price of the shoes: 40% of \$40 is $(40/100) \cdot \$40 = \$16$, so the new price of the shoes is $\$40 - \$16 = \$24$. At this point, we can work with the answers to figure out which one is correct: increase each answer by 20% until we get \$24. The correct answer is B since 20% of \$20 is \$4 and $\$20 + \$4 = \$24$.

**12.** D

Sometimes, an SAT question will seem to ask you to list out a huge sequence of numbers; however, this will never be the correct way to do the problem. The sequence in this problem is called an *arithmetic* sequence because each term is the same amount more than the previous term. So, whatever number the $5790^{\text{th}}$ term is, the $5791^{\text{st}}$ term is 5 bigger, the $5792^{\text{nd}}$ term is another 5 bigger (making it 10 more than the $5790^{\text{th}}$ term), and so forth, making the $5795^{\text{th}}$ term 25 more than the $5790^{\text{th}}$ term.

**13.** C

Try to do this one without a calculator. Since $6 - 7 = -1$, and 314159 is an odd number, then $(6-7)^{314159} = -1$. So, the expression simplifies to $12 \div 3 + 3 \times (-1) = 4 + (-3) = 1$. Remember that you do operations in "PEMDAS" order, so that multiplication and division are done before addition.

**14.** B

Try writing out the first and last parts of the sum: $1+3+5+\ldots+95+97+99$. On any question like this on the SAT where getting the answer would normally take a very long time even on a calculator, there is another way: find a pattern. Notice that $1 + 99 = 100$, $3 + 97 = 100$, $5 + 95 = 100$, and so forth, up to $49 + 51 = 100$. There are 25 of these pairs, all adding to 100, so the answer is $25 \cdot 100 = 2500$.

**15.** D

The easiest way to solve this problem is to *work with the answers*. Make a fraction using each answer in turn as the denominator until it works. For example, if the answer is C, then the numerator is 2, since the fraction has to be equivalent to 1/2, and $2/4 = 1/2$. Adding 3 to the numerator and 4 to the denominator of the fraction 2/4 results in a new fraction of 5/8, which is *not* equivalent to 3/5, so C is incorrect.

Using answer D, the fraction is 3/6 since $3/6 = 1/2$, and the new fraction is 6/10, which *is* equivalent to 3/5, so D is the correct answer.

**16.** 360

First, determine the prime factors of 30 and 102:

$$30 = 2 \times 3 \times 5,$$
$$102 = 2 \times 3 \times 17.$$

To find the greatest common factor of two numbers, multiply all prime factors that the numbers have in common. The greatest common factor of 30 and 102 is therefore $2 \times 3 = 6$. An easy way to find the least common multiple of two numbers is to look at the multiples of the largest number until you find a multiple of the smallest number. Here, we need to look at the multiples of 15 until we find a multiple of 12. Now, 15, 30, and 45 aren't divisible by 12, but 60 is, so 60 is the least common multiple of 12 and 15. At last! The answer is: $6 \times 60 = 360$.

**17.** 0.99

The easiest way to solve this problem is to *plug in real numbers*; in this case, plug in an easy number for the original price of the cabbage. For percents problems, a number like 100 is often a good choice. If the cabbage costs \$100, the new price after a 10% decrease is $\$100 - (10/100) \cdot \$100 = \$90$, and the final price after a 10% increase is $\$90 + (10/100) \cdot \$90 = \$99$, so the answer is $\$99/\$100 = 0.99$.

# SAT Math Facts & Formulas Review Quiz

## *Algebra and Functions*

**1.** D

Let $x$ be the number. Then, expressing the words as algebra: $2x + 12 = 3x - 6$. Solving for $x$ gives $x = 18$.

**2.** C

You should be able to factor the left-hand side of the equation as follows:

$$x^2 + 5x - 14 = (x + 7)(x - 2) = 0$$

so that either $x = -7$ or $x = 2$. Be careful to read the question: since the problem specified $x > 0$, the answer is *not* A; instead, the answer is C, or $x = 2$.

**3.** C

The left hand side of the equation can be written as $2^{2x}$ since $(x^a)^b = x^{a \cdot b}$. Also, note that $64 = 2^6$, so the equation becomes $2^{2x} = 2^6$. Since the base is the same on both sides of the equation, the exponents must be equal: $2x = 6$ so that $x = 3$. Another way to solve this problem is by plugging in the answers.

**4.** E

Since $x^a/x^b = x^{a-b}$, the left hand side of the equation can be written as $5^{n-3}$. Since the base is the same (5) on both sides of the equation, the exponents must be equal: $n - 3 = 7$ so that $n = 10$. Another way to solve this problem is by plugging in the answers into the equation until it works (a calculator may be useful).

**5.** D

You should be able to recognize the expression $121 - x^2$ as a "difference of squares", since $11^2 = 121$. For any $a$ and $b$, $a^2 - b^2 = (a - b)(a + b)$, so $121 - x^2 = 11^2 - x^2 = (11 - x)(11 + x)$, and the answer is D. Alternately, trying expanding the answers by using "FOIL" to see that only D is correct.

**6.** 0

A function is a recipe for taking a number (the input, which is often given by $x$) and making a new number as output (often assigned to $y$). Recall that the domain of a function is all of the possible values that may be input into the function. In this case, the recipe is "take the square root of the input number", and the domain is all possible values for $x$ that may be plugged into $\sqrt{x}$. Only non-negative numbers may be used in a square root, and the smallest non-negative number is 0.

**7.** 1

Recall that the range of a function is all of the possible values that occur as the output of the function (the output is usually assigned to $y$). The question is asking: what is the biggest number that $f(x)$ can be? You can see that $1 - x^2$ only gets smaller as $x$ gets more positive or more negative and is biggest when $x = 0$ (a graphing calculator may be helpful here: try plotting $y = 1 - x^2$). The answer is the output value of the function when $x = 0$: $f(0) = 1 - 0^2 = 1$.

**8.** A

We need to determine $g(2)$ and $g(3)$ and subtract. To find $g(2)$, set $x$ equal to 2 in the expression for $g(x)$ to get: $g(2) = 2(2) - 3 = 1$. Similarly, $g(3) = 2(3) - 3 = 3$, so that the answer is $1 - 3 = -2$.

**9.** D

Even if something other than a number is given inside the parentheses of a function, the rule is the same: substitute the expression inside the parentheses for $x$ in the function definition. For example, if $g(x) = 2x+1$, then $g(\text{cabbage}) = 2\cdot\text{cabbage}+1$. For this problem, substitute $3a$ for $x$ to get $f(3a) = 2(3a)^2 = 18a^2$. Since $2f(3a) = 144$, then $36a^2 = 144$ so that $a^2 = 4$ and $a = \pm 2$, making answer D correct. (Note that $-2$ is not listed as a choice: there can only be one answer.)

**10.** D

The total cost in dollars of the first seven ounces is $7 \times \$0.25 = \$1.75$. After the first seven ounces, each additional ounce costs \$0.15, so the total cost in dollars of a cabbage weighing $c$ ounces is $1.75 + .15 \times (c - 7)$. Answer E is a "trap": we had to multiply 0.15 by $c - 7$, not by $c$, since the cost is 0.15 dollars for each additional ounce after the first seven. Remember, a hard question on the SAT will have "trap" answers that initially look right but come from making mistakes or not reading the question carefully.

A good strategy to solve this particular problem is to *plug in real numbers* for $c$. For example, we know that an 8-ounce cabbage will cost $\$1.75 + \$0.15 = \$1.90$. Now, go through the answers, plugging in 8 for $c$. Only answer D results in a cost of \$1.90.

**11.** E

Each SAT usually has a math question involving a strange symbol that you probably haven't seen before in math class. Don't worry, because the question will define exactly what the symbol means!

For this problem, the question tells us that $a \nabla b = 2a + 3b$. So, to calculate $3 \nabla 2$, we plug in 3 for $a$ and 2 for $b$ into the equation $2a + 3b$, resulting in: $3 \nabla 2 = 2(3) + 3(2) = 12$. Since $6 \nabla 0 = 2(6) + 3(0) = 12$, answer E is correct.

**12.** 7

Multiply both sides of the equation by $x$ to get: $x^2 + 7 = 8x$, which we can rewrite as $x^2 - 8x + 7 = 0$. Factor this trinomial: $(x - 7)(x - 1) = 0$ so that either $x = 7$ or $x = 1$. Since the question stated that $x > 1$, the answer is 7.

**13.** 256

First, remember that $x^{1/2} = \sqrt{x}$. Also, a number raised to a negative exponent is equivalent to the reciprocal of the number raised to the exponent without the minus sign. So, $x^{-1/2} = 1/x^{1/2} = 1/\sqrt{x}$, and the equation can be rewritten as: $1/\sqrt{x} = 1/16$, or $\sqrt{x} = 16$ so that $x = 256$.

# SAT Math Facts & Formulas Review Quiz

## *Geometry*

**1.** C

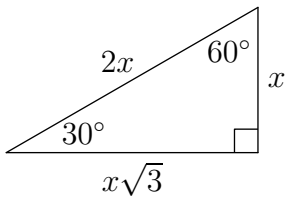
The area of a circle is $\pi r^2$. Since the area of the given circle is $81\pi$, we see that $r^2 = 81$, or $r = 9$. The circumference of a circle is $2\pi r$, so the answer is $18\pi$.

**2.** B

The circumference of a circle is $2\pi r = \pi d$, so the ratio of the circumference of a circle to twice the diameter of the circle is $\pi d/(2d) = \pi/2$.

**3.** A

First, notice that the given triangle is a 30-60-90 triangle. This type of triangle is given to you on the first page of each SAT math section, as shown below:




From this figure, we see that the side opposite the 60° angle is $\sqrt{3}$ times as big as the side opposite the 30° angle. So, for this problem, we need to divide the given side of length 6 by $\sqrt{3}$, giving $x = 6/\sqrt{3} = 6\sqrt{3}/3 = 2\sqrt{3}$.

**4.** D

Since triangle $ABC$ is a right triangle, we can use the Pythagorean Theorem ($a^2 + b^2 = c^2$) to give us the length of the hypotenuse (side $BC$). (Hint: when you are not given a diagram for a geometry question, *draw your own* and label it with the given information.) Since $a = 6$ and $b = 8$ we have $c^2 = 36 + 64 = 100$ so that $c = 10$.

Even better (because it is faster), recognize that this triangle is one of the common right triangles: 6–8–10, so that $BC = 10$.

**5.** E

Since the area of a rectangle is $A = lw$, and here the width is $w = 7$, the length of the rectangle is $168/7 = 24$. Triangle $ABC$ is a right triangle, so we can use the relationship $c^2 = a^2 + b^2$ to give us the length of the hypotenuse ($\overline{AC}$): $c^2 = 7^2 + 24^2$ so that $c = 25$.

You may also recognize this triangle is one of the common right triangles: 7–24–25, making $AC = 25$.

**6.** E

An important rule to remember about triangles is called the "third side rule": the length of the third side of a triangle is less than the sum of the lengths of the other two sides and greater than the (positive) difference of the lengths of the other two sides. For this triangle, the length of the third side must be greater than $9 - 7 = 2$ and less than $9 + 7 = 16$. All the answers are possible except for answer E, which is equal to 16 but not less than 16.

**7.** C

The third side rule says that the length of the third side of the triangle in this case must be less than $5 + 8 = 13$. Since the length of the third side is an integer, the length must be 12. The biggest possible perimeter is then $5 + 8 + 12 = 25$.

**8.** B

The equation of a line in slope-intercept form is: $y = mx + b$, where $m$ is the slope and $b$ is the $y$-intercept. We find the slope from the two points: $m = \text{rise/run} = \Delta y/\Delta x = (10 - 2)/(5 - 1) = 2$. This makes the equation: $y = 2x + b$. Now, we find $b$ by plugging in one of the two points into this equation. Using $(1, 2)$ as our point to plug in, $2 = 2(1) + b$ so that $b = 0$. The answer is $y = 2x$.

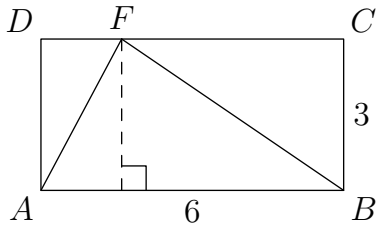
**9.** D

A very useful math fact to know for the SAT and ACT tests is the following: Perpendicular lines have negative reciprocal slopes: $m_1 \cdot m_2 = -1$. The slope of line $l$ is $m = \text{rise/run} = \Delta y/\Delta x = (10 - 2)/(5 - 1) = 2$, so that the slope of a line perpendicular to $l$ must be $-1/2$.

The equation of a line perpendicular to $l$ must be in the form: $y = (-1/2)x + b$, or $2y = -x + 2b$, or $x + 2y = 2b$. Only answer D is in this form (with $b = 3$).

**10.** 9

It can be very helpful to draw extra lines in the diagrams for some SAT geometry problems. In this case, draw a line from $F$ perpendicular to the base of the rectangle:




To find the area of the triangle, we need the base and the height of the triangle. The length of the base of the triangle is the same as the length of the rectangle (6). From the figure, the height of the triangle is the dashed line, and has a length of 3. The area of the triangle is then $(1/2) \cdot 6 \cdot 3 = 9$.

**11.** 2

The volume of a right cylinder is given to you on the first page of each SAT math section: $V = \pi r^2 h$, where $V$ is the volume, $r$ is the radius, and $h$ is the height of the cylinder. A good way to do this problem is to *plug in real numbers*. Any numbers will do as long as they are easy to use (small integers usually work well) and they fit the conditions of the problem.

For this question, let the radius of cylinder $B$ be 1. Then, the radius of cylinder $A$ must be 2. Let the height of cylinder $A$ be 1. Then, the height of cylinder $B$ must be 2. The volume of cylinder $A$ is therefore $\pi \cdot 2^2 \cdot 1 = 4\pi$ and the volume of cylinder $B$ is $\pi \cdot 1^2 \cdot 2 = 2\pi$. The desired ratio is $4\pi/2\pi = 2$.

How would you solve this problem without plugging in numbers? Here is the algebraic solution:

We have: $V_A = \pi r_A^2 h_A$, $V_B = \pi r_B^2 h_B$, $r_A = 2r_B$ and $h_B = 2h_A$. Then,

$$\frac{V_A}{V_B} = \frac{\pi r_A^2 h_A}{\pi r_B^2 h_B} = \left(\frac{r_A}{r_B}\right)^2 \left(\frac{h_A}{h_B}\right) = \left(\frac{2r_B}{r_B}\right)^2 \left(\frac{h_A}{2h_A}\right) = \frac{4}{2} = 2.$$

Ouch! For most people, plugging in numbers is the easiest way to solve this problem.

# SAT Math Facts & Formulas Review Quiz

## *Data, Statistics, and Probability*

**1.** B

To find the average of a set of numbers, we add them up and then divide by the number of numbers. The average of these three numbers is $(3 + 4 + x)/3$, and we know that the average is $-2$. Therefore, $(3 + 4 + x)/3 = -2$ so that $7 + x = -6$ and $x = -13$.

**2.** C

The average of a bunch of numbers is the sum of the numbers, divided by the number of numbers:

$$\text{average} = \frac{\text{sum of the numbers}}{\text{number of numbers}}.$$

Often on the SAT and ACT tests, you will need the same formula, written a little differently:

$$\text{sum of the numbers} = \text{average} \times \text{number of numbers}.$$

For this question, we have five numbers whose average is 10. So, the sum of these numbers is: sum $= 10 \times 5 = 50$, i.e., the five numbers add up to 50. If the fifth number is 6, this means that the first four numbers add up to 44. The average of the first four numbers is then: average $= 44/4 = 11$.

**3.** A

Probability questions on the SAT are often just counting problems in disguise. To determine probability, we need to count the number of ways a desired event can happen, and then divide by the total number of ways the event can happen (whether desired or not).

For this question, we first need to count the numbers of ways we can draw a multiple of 3 from the set $M$. The possibilities are: $-15$, $-12$, $-9$, $-6$, $-3$, 0, 3, 6, 9, 12, and 15; so there are 11 multiples. The total number of integers in set $M$ is 31, so the answer is 11/31.

**4.** C

Since the average of $x$ and $y$ is 100, we know that $(x+y)/2 = 100$, or $x+y = 200$. The question specifies that the two numbers $x$ and $y$ are positive integers with $y > x$. This means that the largest possible value for $y$ will occur when $x$ is the smallest it can be, which is $x = 1$. (Don't forget that 0 is not positive!) Now, if $x = 1$, then $y = 199$, so the correct answer is C.

**5.** E

Probability is defined to be the number of ways an event can turn out the way we want, divided by the total number of ways the event can happen. Here, the desired event is "the number on top of the die is odd." In how many ways can this happen? The possible odd numbers are 1, 3, 5, 7, 9, and 11, so our desired event can occur in 6 ways. Since there are 12 possibilities (in total) for the number on top of the die, the probability is $6/12 = 1/2$.

**6.** B

To determine the median of a list, we first sort the list in numerical order, and then take the number in the middle. The original sorted list is 9, 9, 10, 14, 15, 20, and 27, so the median is originally 14. If we add the number 10 to the list, the new sorted list is 9, 9, 10, 10, 14, 15, 20, and 27. The median of the new list is now $(10+14)/2 = 12$ (remember when there is no number in the middle, you take the average of the two numbers on either side of the middle). So, the median has decreased from 14 to 12. The number of modes of the original list was one (the mode was 9), but for the new list, the number of modes has increased to two (the modes are 9 and 10). Finally, since modes don't like Twinkies, only answer B can be true.

**7.** 2/3, .666, or .667

The easiest way to do this problem is to realize that not picking a carrot is the same as picking either a cabbage or a turnip. Since there are $15 + 25 = 40$ vegetables that are either cabbages or turnips, and there are $15 + 20 + 25 = 60$ vegetables in total, the probability of not picking a carrot is $40/60 = 2/3$. That's too bad; I like carrots.

Alternatively, to find the probability that an event will *not* happen, we can first find the probability that the event *does* happen. Then, we can use the following fact: If the probability of event $A$ happening is $x$, then the probability of event $A$ *not* happening is $1-x$. For this question, we can pick a carrot in 20 ways, and there are a total of $15 + 20 + 25 = 60$ vegetables that we can pick. So, the probability of picking a carrot is $20/60 = 1/3$, making the probability of *not* picking a carrot equal to $1 - 1/3 = 2/3$.