

Top Ten Formulas you need for the PSAT

Example problems included!

Background

The PSAT is not like a most of the tests you've had in school. It covers material from years' worth of math classes, and questions from different areas of math are all mixed together. At Test Prep for Success, we've looked through dozens of past SAT and PSAT tests and compiled a list of all the formulas you will need to know. Check out our *Ultimate Formula Sheet* for the entire list.

However, if you're just starting to study, you need to prioritize. The formulas on this sheet are the 10 most important things you need to learn for PSAT math RIGHT NOW. Test out your skills with the examples, and check your answers using the key on the last page. *You got this!*

#1

$$y = mx + b$$



We counted! Almost 17% of SAT questions require you to be familiar with the slope-intercept formula, easily boosting it to the number one position. Here are three different ways you will see it on the test:

Example 1A) A contracting company purchased construction equipment valued at \$630,000. The value of the equipment depreciates by the same amount each year, so that after 10 years the value will be \$130,000. Which of the following equations gives the value, y , of the equipment x years after it was purchased for the time period $0 \leq x \leq 10$?

- A) $y = 130000 + 50000x$
- B) $y = 130000 - 50000x$
- C) $y = 630000 + 50000x$
- D) $y = 630000 - 50000x$

Example 1B) A model for the speed of sound in air is $v = 331 + 0.6T$ where v is the speed of sound in meters per second and T is the air temperature in $^{\circ}\text{C}$. Given this model, what does the number 0.6 represent?

- A. The speed of sound at an air temperature of 0°C .
- B. The speed of sound at an air temperature of 331°C .
- C. The increase in the speed of sound for each increase of 1°C in air temperature.
- D. The increase in the speed of sound for each increase of 0.6°C in air temperature.

#2

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

This is the slope formula, which is also known as "rise over run."

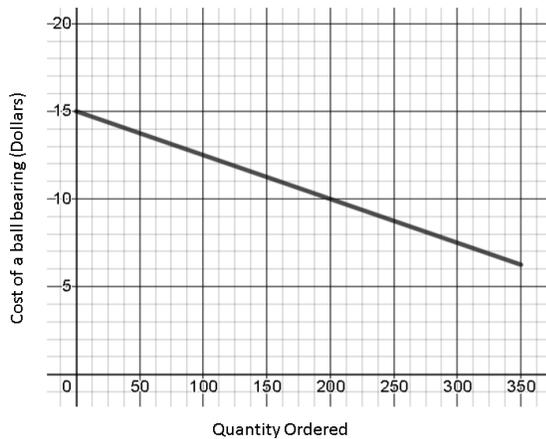
Example 2A) In the xy -plane, line k passes through the points $(0,3)$ and $(6,0)$. Which of the following is an equation of line k ?

- A) $y = -2x + 3$
- B) $y = -\frac{1}{2}x + 3$
- C) $y = \frac{1}{2}x - 3$
- D) $y = 2x - 3$

Example 2B) At a certain dairy farm milk production increased from 450 thousand gallons in 2000 to 3.6 million gallons in 2010. Which of the following linear functions f best models the production, in thousands of gallons, t years after 2000?

- A) $f(t) = 9t + 450$
- B) $f(t) = 315t + 450$
- C) $f(t) = -9t + 450$
- D) $f(t) = -315t + 450$

Example 2C) The line graphed in the xy -plane below models the cost of a ball bearing with respect to the quantity of ball bearings ordered.



According to the graph, by how many dollars is the cost of a ball bearing reduced for each additional ball bearing ordered?

- A) 0.025
- B) 0.25
- C) 4
- D) 6.25

#3 Exponent Rules

To get a top score on the PSAT, you will need to know these three exponent rules like the back of your hand. Sometimes you will use all three in the same question.

Multiplication Rule for Exponents: $a^b \cdot a^c = a^{b+c}$

Division Rule for Exponents: $\frac{a^b}{a^c} = a^{b-c}$

Power Rule for Exponents: $(a^b)^c = a^{bc}$

Example 3) If $\frac{(x^a x^b)^2}{x^{-b}} = x^{-a}$ for all nonzero values of a and b , what is b in terms of a ?

- A) $b = -a$
- B) $b = a^2$
- C) $b = 3a$
- D) $b = -\frac{a}{2}$

#4 $(1 + r)$ and $(1 - r)$

The r value is the percent in decimal form. Use the formula $(1 + r)$ whenever you want to increase a value by a percent, such as multiplying by 1.15 when you are leaving a 15% tip. Use $(1 - r)$ whenever you want to decrease a value by a percent, like multiplying by 0.75 when an item is on sale for 25% off.

Example 4A) Kathie bought a teapot at a kitchen supply store that gave a 25% discount off the original price. The total amount she paid was t dollars, including a 6% sales tax on the discounted price. Which of the following represents the original price of the teapot in terms of t ?

- A) $0.81t$
- B) $\frac{t}{0.81}$
- C) $(0.75)(1.06)t$
- D) $\frac{t}{(0.75)(1.06)}$

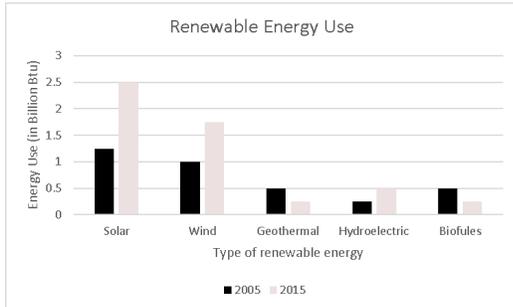


Example 4B) Cam opened a bank account that earns 2 percent interest compounded annually. His initial deposit was \$1500, and he uses the expression $1500(r)^x$ to find the value of the account after x years. What is the value of r in the expression? (Enter your answer into the grid.)

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#5 $\frac{|old - new|}{old} \times 100\%$

Use the last two formulas when you are given the percent change. Use this formula when you are given the starting and ending values and need to calculate the percent change for yourself. You get the numerator by subtracting the numbers. The older, or original, of the two numbers will go in the denominator.



Example 5) Of the following, which best approximates the percent increase in solar power between 2005 and 2015?

- A) 50%
- B) 75%
- C) 100%
- D) 125%

#6 $average = \frac{sum\ of\ terms}{number\ of\ terms}$

This is the same formula you use to calculate your baseball stats or your gpa. You might see it called average, mean, or arithmetic mean.

Example 6) The average height of the 10 players on the Little Dribblers junior basketball team is 50 inches. If the tallest member were to drop out of the team, the average height would decrease to 48.5 inches. How tall in inches is the tallest Little Dribbler?



- A) 51.5
- B) 60
- C) 63.5
- D) 65

#7 $D = RT$

Distance equals Rate times Time is a formula from science class, but you will need it for the PSAT, too. Be careful to give your answer in the correct units.

Example 7) If Usain Bolt runs at 27.79 miles per hour along a track that is 0.25 miles long, how many seconds did the run take? (Round your answer to the nearest second when gridding it in.)

#8 $probability = \frac{desired\ outcomes}{possible\ outcomes}$

The PSAT will usually have you calculate the probability from a table. Find the denominator first, then the numerator. Finally, simplify the fraction or convert it to a decimal or percent.

Example 8A) Mr. O’Meara teaches Algebra I, Algebra II, and Geometry classes. Some of his students come to school in person, and others take his classes online. The table below shows the number of students in each of Mr. Lesko’s three classes and which mode of learning they are using.

	In Person	Online	Total
Algebra I	12	21	33
Algebra II	15	10	25
Geometry	22	8	30
Total	49	39	88

If one of Mr. O’Meara’s Geometry students is selected randomly, what is the probability that the student is taking the class online?

- A) $\frac{1}{11}$
- B) $\frac{4}{11}$
- C) $\frac{15}{44}$
- D) $\frac{4}{15}$

Example 8B) The following table gives the numbers of tickets sold for a play. Ticket types are based on whether it is purchased for an adult, child, or senior, and whether the seat is located in the orchestra, mezzanine, or balcony.

	Orchestra	Mezzanine	Balcony	Total
Adult	255	206	182	643
Child	61	27	47	135
Senior	178	79	5	262
Total	494	312	234	1040

If a ticket for a seat in the balcony is selected at random, which of the following is closest to the probability that it will be an adult ticket?

- A) 0.175
- B) 0.364
- C) 0.778
- D) 2.748

#9 $P = 2(l + w)$

This is the formula for *perimeter of a rectangle*. The PSAT gives you the formula for area of a rectangle at the beginning of every math section, but not this one.

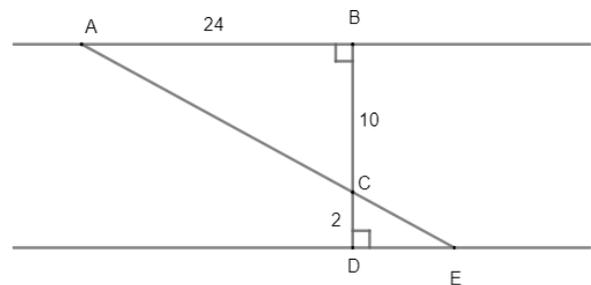
Example 9) A rectangle has perimeter P , length x , and width y . Which of the following represents the length in terms of P and y ?

- A) $x = \frac{2P-y}{2}$
- B) $x = 2P - 2y$
- C) $x = P - y$
- D) $x = \frac{P-2y}{2}$

#10 *Pythagorean Triples*

The Pythagorean Theorem, $a^2 + b^2 = c^2$, can be used to find the third side of a right triangle when you know the lengths of any two sides. However, you can skip solving this equation and jump directly to the answer if you have memorized the Pythagorean triples of 3-4-5 and 5-12-13.

Example 10) In the figure below, \overline{AB} is parallel to \overline{DE} , and \overline{BD} and \overline{AE} intersect at C. What is the length of segment \overline{AE} ?



- A) 27.9
- B) 31.2
- C) 36.0
- D) 38.0



Answers:

1A: D

1B: C

2A: B

2B: B

2C: A

3: A

4A: D

4B: 1.02

5: C

6: C

7: 32

8A: D

8B: C

9: D

10: B