Math Review for the PSAT

A Correlation of the Math Problems on the first nine tests in the Book **10 Real SATs Third Edition** to Math Topics

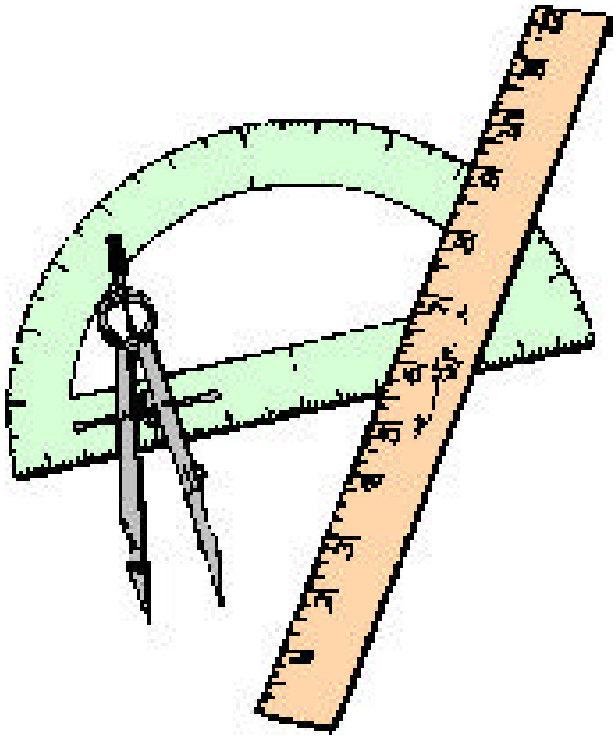
NOTE: Quantitative comparison questions are no longer on the PSAT. While the book 10 Real SATs Third Edition contains quantitative comparison questions, these are not included in the following.

The following pages divide the math problems on the first nine tests in the book 10 Real SATs Third Edition into 28 sets of problems.

In each group the problems are generally listed in order of difficulty with the easier problems listed first.

The student should work as many problems as he or she can in each group and should work through all of the groups.

Groups



#1

Solving by Inserting a Value

Every time you see a variable, consider inserting a value.

This is a very powerful technique. Inserting a value changes an algebra problem into an arithmetic problem, usually an easier situation. Many problems can be solved by inserting a value for the variable or variables. In this way a student who is not confident with algebra can still find the correct answer.

The following are three types of inserting the value problems.

Type #1 - Insert or test each of the five answer choices to see which satisfies the conditions of the problem.

Example 1: For which of the following values of t will $t^2 = -t$?
(A) -1 only (B) 0 only (C) -1 and 1 (D) 0 and 1 (E) -1 and 0

To solve, insert each answer choice for t to see which choice causes t^2 to be equal to -t.

For **(A)**, when -1 is inserted for t, the result is $(-1)^2 = -(-1)$ or $1 = 1$ which is a true statement. Therefore t can equal -1.
For **(B)**, when 0 is inserted for t, the result is $(0)^2 = -(0)$ or $0 = 0$, which is a true statement. Therefore, t can equal 0.
For **(C)**, you already know that -1 works, and when 1 is inserted for t, the result is $(1)^2 = -(1)$ or $1 = -1$, which is not true. Therefore, t cannot be equal to 1.
For **(D)**, you already know that t cannot be equal to 1
For **(E)**, you already know tha both -1 and 0 work, so **(E)** is the correct answer choice.

You may have noticed that after you found that -1 and 0 both work, the answer would have to be (E).
The following is how you can solve Example 1 with algebra.

$t^2 = -t$
add t to both sides of the equation to get $t^2 + t = 0$
factor $t(t + 1) = 0$
therefore $t = 0$ and $t + 1 = 0$,
$t = 0, t = -1$

Example 2: For a movie an adult ticket costs $3.00 more than a student ticket. If the total cost for one adult ticket and three student tickets is $27.00, what is the cost of a student ticket.
(A) $3.00 (B) $4.00 (C) $5.00 (D) $6.00 (E) $7.00

To solve, test each answer choice until you find the choice that satisfies the conditions of the problem.
For (A), there will be three student tickets at $3 each and one adult ticket at $6 for a total cost of $15.
For (B), three student tickets at $4 each and one adult ticket at $7 for a total cost of $19.
For (C), three student tickets at $5 each and one adult ticket at $8 for a total cost of $23.
For (D), three student tickets at $6 each and one adult ticket at $9 for a total cost of $27.
For (E), three student tickets at $7 each and one adult ticket at $10 for a total cost of $31.
The choice that satisfies the conditions of the problem that the total ticket cost is $27 and an adult ticket costs $3 more than a student ticket is **(D)**.

The following is how you can solve the problem with algebra:
Let the cost of a student ticket be s. Let the cost of an adult ticket be s + 3.
The total cost ($27) is the cost of three student tickets (3s) plus the cost of one adult ticket (s + 3).

$27 = 3s + s + 3$
$27 = 4s + 3$
$24 = 4s$
$6 = s$

You can use either method. However, if you have difficulty with algebra, consider testing the answer choices until you find the choice that satisfies the conditions of the question.

Type #2 - Insert your own values for the variables. You must make sure that you satisfy all conditions given in the problem.

Example 1: The number X - 2 is how much less than X + 2?
(A) 0 (B) 2 (C) 4 (D) 2X (E) X - 4

You can solve the problem by choosing any value for X and finding the corresponding answer. If, for example, you choose 10 for the value of X, then the problem becomes

10 - 2 (which is 8) is how much less than 10 + 2 (which is 12)?
Since 8 is 4 less than 12, the answer is **(C)** 4.

The following is how you can solve Example 1 with algebra.

X + 2 - (X - 2) = X + 2 - X + 2 = **4**

Example 2: If a, b, c, and d are all positive, and a = 2b, b = 3c, and 4c = d, then a/d =
(A) 2 (B) 3 (C) 2/3 (D) 3/2 (E) 4/3

You can solve the problem by choosing values for a, b, c, and d that cause both sides of each equation to be equal. For example, if you let d = 4, then c = 1. If c = 1, then b = 3. If b = 3, then a = 6. Therefore, a/d = 6/4 = **3/2**, choice (D).

The following is how you can solve Example 1 with algebra.

a = 2b
a = 2(3c)
a = 6c
a = 6(d/4)

$$a = \frac{3d}{2}$$

$$\left(\frac{1}{d}\right)\left(\frac{a}{1}\right) = \left(\frac{3d}{2}\right)\left(\frac{1}{d}\right)$$

$$\frac{a}{d} = \frac{3}{2}$$

Type #3 - A very difficult problem on a PSAT or SAT is one in which all of the answer choices are expressions such as the following five choices: (A) 2d/g (B) d/2g (C)2dg (D) 2g/d (E) gd/3. For this type of question, you can use the famous *3-step E-Z McSqueezy Method*. This method allows you to use arithmetic to solve a difficult algebra problem. The following are the 3 steps.

Step 1: Choose your own value for each variable in the problem.
Step 2: Answer the question using your values for the variables.
Step 3: Insert your values for the variables into each of the five answer choices, and find the answer choice that matches your answer from step 2.

Example 1: The total cost of g gallons of gas is d dollars. What is the cost of 2 gallons of gas? All answers are in dollars.
(A) 2d/g (B) d/2g (C)2dg (D) 2g/d (E) gd/3

Step 1: Insert your own values for g and d. For example, let g = 10 and d = 40.
Step 2: Answer the question using your chosen values for the variables. If g = 10 and d = 40, then the first sentence of the problem becomes "The total cost of *10* gallons of gas is *40* dollars. Therefore, 1 gallon of gas costs 4 dollars. The question asks for the cost of 2 gallons of gas which would be **8** dollars.
Step 3: Insert our chosen values (10 for g and 40 for d) into each of the five answer choices to see which result matches the answer of **8** from Step 2. The following are the results: (A) **8** (B) 2 (C) 800 (D) 1/2 (E) 400/3
The answer is (A) 4 since this matches the answer from Step 2.
If more than one of the five answer choices matches your answer from Step 2, you must repeat the process with new values. However, the second time, you just test the answer choices that worked the first time. The answer choice that gives the correct answer (matches your answer from Step 2) both times is the answer to the problem.

More of the 3-step E-Z McSqueezy Method

Step 1: Choose your own value for each variable in the problem.
Step 2: Answer the question using your values for the variables.
Step 3: Insert your values for the variables into each of the five answer choices, and find the answer choice that matches your answer from step 2.

Example 2: If you subtract 4 from x, divide this sum by 3, and add 2 to this quotient, which of the following is the result of performing those operations.

(A) $\frac{x-2}{3}$ (B) $\frac{x-2}{6}$ (C) $\frac{x+2}{6}$ (D) $\frac{x+2}{3}$ (E) $\frac{10-x}{3}$

Step 1: Insert your own value for x. For example, let x = 10.
Step 2: Answer the question using your chosen values for the variables. If x = 10, then 4 from 10 is 6, and 6 divided by 3 is 2, and 2 plus 2 is **4**. Four is the answer when you let x = 10
Step 3: Insert 10 for x into each of the answer choices to see which results in 4.
(A) 8/3 (B) 8/6 = 4/3 (C) 12/6 = 2 (D) 12/3 = **4** (E) 0

The answer is (D) since this matches the answer from Step 2.

Example 3: The price of a dog, after it was reduced 20%, was D dollars. What was the price of the dog before the reduction?
(A) \$1.80D (B) \$1.25D (C) \$1.20D (D) \$0.80D (E) \$0.75D

Step 1: This is a little different because you start by choosing an original price for the dog and then find D which is 20% less than the original price. Since the problem involves percents, let's choose \$100 for the dog's original price. The value of D will be 20% less than the original price or \$80.
Step 2: The question asks for the price of the dog before the reduction which is **\$100**.
Step 3: Insert the value of D, 80, into each answer choice to see which results in \$100.
(A) \$1.80(80) = \$144.00 (B) \$1.25(80) = **\$100.00** (C) \$1.20(80) = \$96.00 (D) \$0.80(80) = \$64.00 (E) \$0.75(80) = \$60.00

The answer is (B) since this matches the answer from Step 2.

The following problems, all of which are in the book 10 Real SATs Third Edition, can be solved in part or whole by using the strategies that have just been presented. Problems are in a general order of difficulty with the easier problems listed first.

Try to solve each problem by inserting a value for the variables. This may not be the best or easiest method to solve some of the problems, but for practice purposes, try inserting values. If a problem has *EZ* next to it, this means that the problem can be solved by the famous *3-step E-Z McSqueezy Method*.

1. Page 309 #1
2. Page 429 #3
3. Page 449 #1
4. Page 449 #3
5. Page 469 #1
6. Page 506 #1
7. Page 571 #1
8. Page 289 #7
9. Page 370 #6
10. Page 371 #7
11. Page 384 #18
12. Page 404 #6
13. Page 404 #7
14. Page 450 #6
15. Page 464 #19
16. Page 484 #5
17. Page 499 #18
18. Page 610 #15 *EZ*
19. Page 291 #15
20. Page 326 #13
21. Page 346 #3
22. Page 348 #8
23. Page 371 #11
24. Page 372 #15
25. Page 385 #23
26. Page 390 #5
27. Page 405 #10 *EZ*
28. Page 407 #16
29. Page 419 #20
30. Page 451 #12 *EZ*
31. Page 451 #14
32. Page 453 #19
33. Page 484 #7 *EZ*
34. Page 484 #8
35. Page 485 #11
36. Page 485 #13
37. Page 485 #14
38. Page 526 #14
39. Page 575 #20
40. Page 611 #19
41. Page 637 #6
42. Page 340 #23
43. Page 374 #22
44. Page 374 #23
45. Page 408 #23
46. Page 420 #23
47. Page 472 #9
48. Page 508 #7
49. Page 327 #19 *EZ*
50. Page 527 #22 *EZ*
51. Page 528 #23
52. Page 293 #25 *EZ*
53. Page 392 #9 *EZ*
54. Page 392 #10 *EZ*
55. Page 453 #21 *EZ* (see #20 first)
56. Page 454 #25 *EZ*
57. Page 509 #9
58. Page 528 #24 *EZ*
59. Page 549 #9 *EZ*
60. Page 576 #23 *EZ*

#2

Weird and Unfamiliar Symbols or Words

On every PSAT and SAT that we have ever seen, there are one or more problems that contain what might be called weird and unfamiliar symbols or words.

The meaning of a symbol or word is based on the definition that is given for the question. Usually, this is a definition that has been created by the test maker. The idea is to see whether you can apply a definition.

The best way to do the problem is to form a sentence explaining to yourself the meaning of the symbol. Begin your sentence with the words, "The symbol means . . . . ."

Example 1: For $X \neq 0$, let $\textcircled{X} = X + \frac{1}{X}$. What is the value of $\textcircled{4}$?

Your sentence should be similar to the following: "The symbol means that you take the number inside the circle and add it to one over the number inside the circle."

4 + 1/4 = **4 1/4**. If this is a gridding question, you would grid either 17/4 or 4.25.

There are two basic types of weird symbol questions. The first, as shown in example 1, asks you to apply the definition and solve an arithmetic problem. The second, as shown in example 2 below, asks you to apply the definition and solve an algebra problem.

Example 2: Let $\begin{array}{ccc} & a & \\ d & \times & b \\ & c & \end{array} = (a)(c) - (b)(d)$. If $\begin{array}{ccc} & a & \\ 6 & \times & 4 \\ & 8 & \end{array} = 16$, find a.

The symbol means that you take the top number times the bottom number and then subtract the product of the right number times the left number.

$\begin{array}{ccc} & a & \\ 6 & \times & 4 \\ & 8 & \end{array} = 16$

Apply the definition. (a)(8) - (4)(6) = 16
Solve the problem. 8a - 24 = 16
8a = 40
a = 5

Do the following problems to help you with the concept of weird symbols or words.

1. Page 303 #16
2. Page 608 #4
3. Page 290 #10
4. Page 290 #11
5. Page 290 #12
6. Page 372 #14
7. Page 406 #13
8. Page 406 #14
9. Page 406 #15
10. Page 453 #20
11. Page 453 #21
12. Page 527 #18
13. Page 527 #19
14. Page 527 #20
15. Page 539 $21
16. Page 373 #21
17. Page 465 #24
18. Page 487 #20
19. Page 500 #23
20. Page 587 #22
21. Page 328 #23
22. Page 612 #24
23. Page 624 #25

#3 Number Logic

If a person only had one hour to prepare for the PSAT, we would have him or her do the following problems. We call them number logic problems. Expect 5 to 8 problems like this on the PSAT.

The problems deal with odd numbers, even numbers, prime numbers, digits, whether numbers are positive or negative, consecutive integers, identity of multiplication, divisors, multiples, decimals, greater than or less than, sets, sequences, rounding, median and mode, possible combinations or arrangements, and remainders.

1. Page 403 #2
2. Page 449 #3
3. Page 506 #2
4. Page 547 #4
5. Page 571 #3
6. Page 591 #2
7. Page 324 #5
8. Page 324 #8
9. Page 390 #3
10. Page 450 #6
11. Page 463 #17
12. Page 484 #5
13. Page 572 #6
14. Page 607 #1
15. Page 636 #4
16. Page 290 #10
17. Page 290 #11
18. Page 290 #12
19. Page 291 #16
20. Page 292 #19
21. Page 346 #3
22. Page 385 #23
23. Page 390 #5
24. Page 407 #18
25. Page 419 #18
26. Page 451 #14
27. Page 452 #15
28. Page 485 #11
29. Page 508 #6
30. Page 525 #12
31. Page 539 #19
32. Page 623 #20
33. Page 293 #24
34. Page 373 #20
35. Page 420 #24
36. Page 431 #7
37. Page 471 #7
38. Page 486 #18
39. Page 575 #18
40. Page 576 #22
41. Page 610 #16
42. Page 611 #22
43. Page 293 #22
44. Page 293 #23
45. Page 328 #22
46. Page 328 #24
47. Page 454 #24
48. Page 487 #21
49. Page 526 #16
50. Page 575 #21
51. Page 576 #24
52. Page 594 #10

#4 Interpreting Graphs, Charts, and Tables

Expect 1 or 2 graph, chart, or table questions.

1. Page 370 #3
2. Page 486 #16
3. Page 523 #2
4. Page 607 #2
5. Page 609 #12
6. Page 609 #13
7. Page 346 #2
8. Page 430 #5
9. Page 430 #6
10. Page 311 #6
11. Page 311 #7
12. Page 347 $5
13. Page 391 #7
14. Page 453 #22
15. Page 500 #24
16. Page 548 #5
17. Page 548 #6
18. Page 623 #21
19. Page 452 #17
20. Page 337 #15
21. Page 374 #24
22. Page 432 #10

#5 Probability

Expect at least 1 probability question.

1. Page 430 #5
2. Page 451 #11
3. Page 498 #17
4. Page 525 #11
5. Page 305 #24
6. Page 384 #21
7. Page 340 #25

#6

Ratio and Proportion

$$\frac{a}{b} = \frac{x}{y}$$

A ratio is a comparison of two numbers by division.

Example: If there are 10 boys and 15 girls in a geometry class, the ratio of boys to girls is $\frac{10}{15}$ or $\frac{2}{3}$, and this may be written 2:3.

The ratio of girls to boys is $\frac{15}{10}$ or $\frac{3}{2}$, and this may be written 3:2.

The ratio of boys to students is $\frac{10}{25}$ or $\frac{2}{5}$, and this may be written 2:5.

The ratio of girls to students is $\frac{15}{25}$ or $\frac{3}{5}$, and this may be written 3:5.

The way to start a problem involving a ratio is to write a fraction using the words of the items in the ratio.

If you are asked for the ratio of boys to girls, you should immediately write: $\frac{\textbf{boys}}{\textbf{girls}}$

If you are asked for the ratio of cats to dogs, you should immediately write: $\frac{\textbf{cats}}{\textbf{dogs}}$

If you are asked for the ratio of the shaded region to the unshaded region, you should immediately write:

$\frac{\textbf{shaded}}{\textbf{unshaded}}$

There is a $1,000,000 fine if you fail to write the ratio with words.

A proportion is an equation involving two ratios.

Example: $\frac{\mathbf{6}}{\mathbf{16}} = \frac{\mathbf{3}}{\mathbf{8}}$, $\frac{\mathbf{a}}{\mathbf{b}} = \frac{\mathbf{x}}{\mathbf{y}}$

You can solve a proportion that has one unknown by cross multiplying.

If $\frac{3}{10} = \frac{x}{30}$, then $10(x) = (3)(30)$

$10x = 90$

$x = 9$

Expect 1 or 2 ratio and proportion problems.

1. Page 288 #2
2. Page 469 #2
3. Page 622 #17
4. Page 289 #6
5. Page 383 #17
6. Page 499 #19
7. Page 523 #4
8. Page 291 #14
9. Page 408 #21
10. Page 420 #22
11. Page 450 #9
12. Page 487 #23
13. Page 500 #25
14. Page 524 #8
15. Page 526 #15
16. Page 326 #12
17. Page 327 #20

#7

Average

One of the keys to many averaging problems is to find the total amount of the values being averaged.

If Clinton Portis gained an average of 5 yards per carry for 10 carries of the football, what was his total yardage gained? (5)(10) = 50 total yards.
If Rosa made an average of $40 a week for 8 weeks babysitting, what was the total amount of money she made? (40)(8) = $320.
If Maria had an average of 90 on 3 English tests, what was the total or sum of points on the three tests? (90)(3) = 270 total points. Work through the following two questions involving averaging.

Example 1: If the average of 3, 4, 5, 8, and X is 7, what is the value of X.

First, find the total amount. Multiply the average (7) times the number of items (5). The total is 35. Therefore, 3 + 4 + 5 + 8 + X = 35, and X = **15**.

Example 2: If the average of four numbers is 25, and the average of three of these numbers is 20, what is the value of the other number?

First, find the total amount of the four numbers. To do this, multiply the number of items (4) times the average (25). The total is 100. Next, find the total amount of the three numbers whose average is 20. This amount is 60. The value of the other number is 100 - 60, or **40**.

Expect at least 1 averaging problem.

1. Page 483 #2
2. Page 405 #9
3. Page 348 #7
4. Page 430 #6 (see chart at top of page)
5. Page 450 #8
6. Page 573 #10
7. Page 610 #17
8. Page 305 #25
9. Page 385 #25
10. Page 465 #25
11. Page 587 #23
12. Page 540 #25

#8

Percent %

Percent means hundredth.

45% means $\frac{45}{100}$, or 0.45

8% means $\frac{8}{100}$, or 0.08

125% means $\frac{125}{100}$, or 1.25

1000% means $\frac{1000}{100}$, or 10

Percent questions usually contain the words "of" and "is."
In math terms, "of" means multiply and "is" means equals.

Example 1: What **is** 30% **of** 150? Use **x** for **what**, **=** for **is**, and **multiplication parentheses** for **of**.

x = (.3)(150)
x = 45

Therefore, 30% of 150 is **45**.

Percent Continued

Example 2: 5 is what percent of 20?
Rewrite this mathematically using x for the unknown percent. $5 = (x)(20)$

$$\frac{5}{20} = x$$

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

$0.25 = x$, and **x = 25%**

Therefore, 5 is **25%** of 20.

Example 3: 56 is 80% of what number?
Rewrite this mathematically using n for the unknown number. $56 = (.8)(n)$

$$\frac{56}{.8} = n$$

70 = n

Therefore, 56 is 80% of **70**.

Example 4: After the price of a dog was reduced by 20%, it sold for $40. What was the original price of the dog?
Rewrite this mathematically using p for the original price of the dog.

$$p - (.2)(p) = 40$$
$$(.8)(p) = 40$$
$$p = \frac{40}{.8} = \mathbf{50}$$

Therefore, the original price of the dog was **$50**.

Make sure that you know these **%** to fraction conversions.

$50\% = \frac{1}{2}$ $\quad 33\frac{1}{3}\% = \frac{1}{3}$ $\quad 25\% = \frac{1}{4}$ $\quad 20\% = \frac{1}{5}$ $\quad 60\% = \frac{3}{5}$ $\quad 12\frac{1}{2}\% = \frac{1}{8}$

$66\frac{2}{3}\% = \frac{2}{3}$ $\quad 75\% = \frac{3}{4}$ $\quad 40\% = \frac{2}{5}$ $\quad 80\% = \frac{4}{5}$

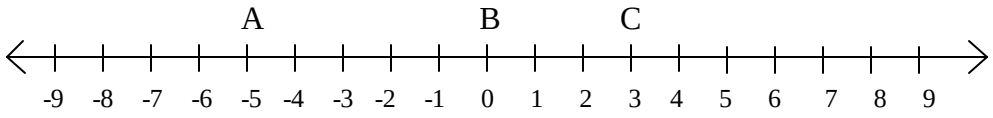
Expect at least 1 percent problem.

The following problems involve %.

1. Page 370 #4
2. Page 571 #2
3. Page 586 #18
4. Page 339 #18
5. Page 405 #11
6. Page 419 #19
7. Page 524 #7
8. Page 608 #5
9. Page 609 #13 (Look at the chart at the top of the page.)
10. Page 637 #7
11. Page 326 #15
12. Page 372 #13
13. Page 464 #20
14. Page 484 #9
15. Page 527 #22
16. Page 293 #25
17. Page 432 #10
18. Page 472 #10

#9 Number Line

When numbers are assigned to points on a line, it is called a number line.



The number corresponding to A, known as its coordinate, is -5.
The coordinate of B is 0.
The coordinate of C is 3.
AC means the distance from A to C or C to A. This distance is 8. AB means the distance from A to B or B to A. This distance is 5. Distance and length are always positive numbers.

It is likely that there will be at least one number line problem.

1. Page 310 #3
2. Page 464 #18
3. Page 608 #8
4. Page 372 #17
5. Page 407 #19
6. Page 524 #9
7. Page 574 #17
8. Page 349 #10

#10 The Coordinate Plane

Expect at least one coordinate plane problem.

1. Page 404 #4
2. Page 289 #5
3. Page 289 #8
4. Page 507 #3
5. Page 546 #2
6. Page 624 #23
7. Page 384 #20
8. Page 419 #21
9. Page 430 #4
10. Page 470 #6
11. Page 484 #10
12. Page 527 #21
13. Page 587 #24

#11 Slope

$$\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Expect at least one slope problem

1. Page 324 #4
2. Page 574 #13
3. Page 407 #17
4. Page 485 #15
5. Page 540 #24
6. Page 574 #14 (look at #13 first)
7. Page 611 #21

#12 Evaluating Expressions

1. Page 403 #1
2. Page 403 #3
3. Page 449 #4
4. Page 463 #16
5. Page 546 #1
6. Page 289 #4
7. Page 304 #18
8. Page 371 #9
9. Page 483 #3
10. Page 451 #10
11. Page 453 #20
12. Page 465 #23

#13 Simplifying Expressions

1. Page 524 #5
2. Page 338 #16
3. Page 384 #19
4. Page 451 #12
5. Page 609 #9
6. Page 624 #22
7. Page 420 #23

#14 Solving Equations

1. Page 288 #1
2. Page 346 #1
3. Page 381 #1
4. Page 418 #16
5. Page 429 #1
6. Page 498 #16
7. Page 506 #1
8. Page 523 #1
9. Page 571 #1
10. Page 585 #16
11. Page 591 #1
12. Page 608 #6
13. Page 622 #16
14. Page 635 #1
15. Page 289 #4
16. Page 304 #18
17. Page 608 #3
18. Page 538 #17
19. Page 539 #18
20. Page 292 #21
21. Page 305 #22
22. Page 484 #8
23. Page 485 #13
24. Page 585 #17
25. Page 528 #24

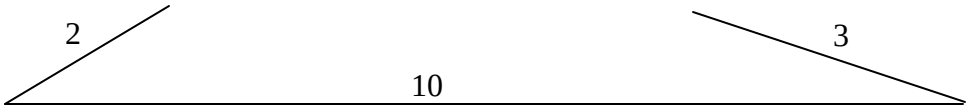
#15 Problems You Can Answer by Writing and Solving an Equation

Many of the following questions can be solved in other ways besides writing and solving an equation. In multiple-choice questions, the answer has to be one of the five answer choices, and you can solve many of these questions by working backwards from the answer choices. This process allows you to use arithmetic instead of algebra. While this is not usually encouraged in a math class, you are definitely encouraged to use this technique (working backwards from the answer choices) on a PSAT or SAT.

1. Page 289 #7
2. Page 405 #11
3. Page 464 #19
4. Page 291 #15
5. Page 304 #21
6. Page 373 #18
7. Page 419 #20
8. Page 485 #12
9. Page 549 #7
10. Page 609 #10
11. Page 638 #9
12. Page 407 #20

#16 Triangle Lengths

Can a triangle have lengths of 2, 3, and 10?



The answer is no. The sides, as you can see, will not reach each other.

The length of any side of a triangle must be less than the sum of the lengths of the other two sides and must be greater than the difference of the lengths of the other two sides.
For example, if the lengths of two sides of a triangle are 8 and 6, the length of the third side must be less than 14 (8 + 6) and greater than 2 (8 - 6).

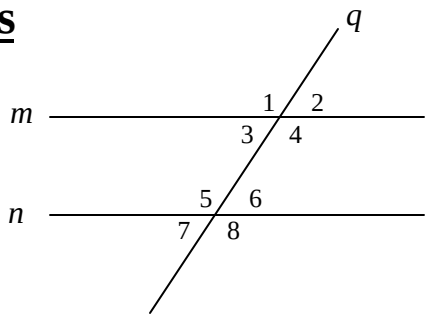
If two sides of a triangle have lengths of 7 and 4, then the following relationship is true regarding the third side (S_3). $7 - 4 < S_3 < 7 + 4$, or $3 < S_3 < 11$.

At first, most students find this to be a difficult concept, and many students miss this type of question. Make sure that you understand this concept before taking a PSAT or SAT.

1. Page 369 #2
2. Page 289 #9
3. Page 406 #12
4. Page 486 #19

#17 Parallel Lines

If two parallel lines (*m* and *n*) are cut by a transversal (*q*), then



The following pairs of angles are congruent and have equal measures:
1) Alternate interior angles, $\angle 3 \cong \angle 6$, $\angle 4 \cong \angle 5$
2) Corresponding angles, $\angle 1 \cong \angle 5$, $\angle 2 \cong \angle 6$, $\angle 3 \cong \angle 7$, $\angle 4 \cong \angle 8$
3) Alternate exterior angles, $\angle 1 \cong \angle 8$, $\angle 2 \cong \angle 7$

Interior angles on the same side of the transversal are supplementary.
$m\angle 3 + m\angle 5 = 180°$
$m\angle 4 + m\angle 6 = 180°$

If m∠1 = 120°, then $m\angle 4 = 120°$, $m\angle 5 = 120°$, $m\angle 8 = 120°$ **and** $m\angle 2 = 60°$, $m\angle 3 = 60°$, $m\angle 6 = 60°$, $m\angle 7 = 60°$

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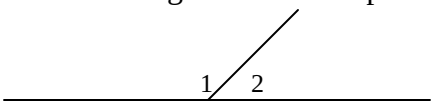
1. Page 450 #5
2. Page 371 #12
3. Page 610 #14
4. Page 310 #5

#18 Angle Measure

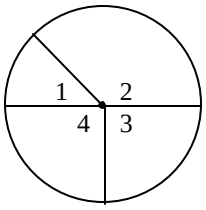
Know the following:

1. The sum of the measures of the three angles of a triangle is 180°.
2. The two angles of a linear pair (two angles that form a straight line) are supplementary. The sum of the measures of the angles of a linear pair is 180°.



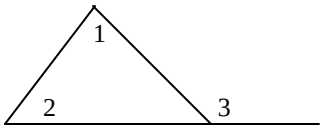
$m\angle 1 + m\angle 2 = 180°$

3. The sum of the measures of the central angles of a circle is 360°.



$m\angle 1 + m\angle 2 + m\angle 3 + m\angle 4 = 360°$.

4. The measure of each angle of an equilateral triangle is 60°.
5. If two sides of a triangle are equal or congruent, then the angles opposite these sides have equal measures.
6. The measure of an exterior angle of a triangle is equal to the sum of the measures of the remote interior angles.



$m\angle 3 = m\angle 1 + m\angle 2$

7. In a triangle, the bigger angle is opposite the bigger side, and the bigger side is opposite the bigger angle.

Expect 2 or 3 angle measure problems.

1. Page 635 #2
2. Page 288 #3
3. Page 369 #2
4. Page 450 #5
5. Page 623 #18
6. Page 371 #12
7. Page 383 #16
8. Page 418 #17
9. Page 469 #3
10. Page 484 #6
11. Page 572 #5
12. Page 304 #19
13. Page 310 #5
14. Page 339 #19
15. Page 450 #8
16. Page 525 #13
17. Page 592 #6
18. Page 407 #20
19. Page 487 #22
20. Page 539 #20
21. Page 594 #9
22. Page 610 #14
23. Page 374 #25
24. Page 528 #25

#19 Perimeter

It is likely that there will be at lease 1 perimeter problem.

1. Page 369 #2
2. Page 292 #18
3. Page 305 #23
4. Page 405 #8
5. Page 500 #22
6. Page 572 #8
7. Page 452 #18
8. Page 610 #18
9. Page 623 #19
10. Page 326 #16

#20

Area

At the beginning of every math section on the PSAT and SAT, reference information is given. Included are the area of a **circle**, area of a **rectangle**, and area of a triangle. Other helpful areas:

Area of a square. $\mathbf{A = s^2}$

Area of a parallelogram. **A = (b)(h)**

Area of an equilateral triangle. $\mathbf{A = \frac{s^2\sqrt{3}}{4}}$

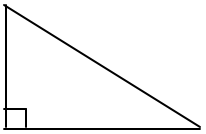
Expect 2 or more area questions.

1. Page 289 #8
2. Page 450 #7
3. Page 608 #7
4. Page 292 #20
5. Page 349 #9
6. Page 373 #19
7. Page 385 #22
8. Page 390 #6
9. Page 408 #22
10. Page 419 #21
11. Page 420 #22
12. Page 464 #21
13. Page 484 #10
14. Page 540 #22
15. Page 575 #19
16. Page 340 #24
17. Page 623 #19
18. Page 528 #23
19. Page 576 #25
20. Page 328 #25
21. Page 454 #23
22. Page 624 #23
23. Page 312 #9
24. Page 549 #10
25. Page 612 #23
26. Page 638 #10

#21

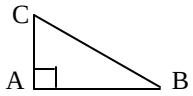
The Pythagorean Theorem and Special Right Triangles

A triangle that contains a right angle or 90° angle is a right triangle. Some SAT or PSAT questions involve finding the lengths of sides of right triangles.



The longest of the three sides of a right triangle is the hypotenuse. The two shorter sides, the sides that form the right angle, are legs.

In right triangle ABC, $\overline{BC}$ is the hypotenuse, and $\overline{AB}$ and $\overline{AC}$ are both legs.

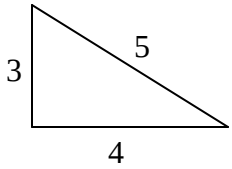


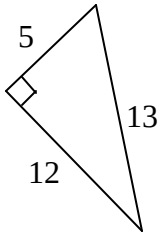
It is important to know and be able to use the Pythagorean theorem, $\mathbf{a}^2 + \mathbf{b}^2 = \mathbf{c}^2$.
The **a** and **b** represent legs of a right triangle and **c** represents the hypotenuse.

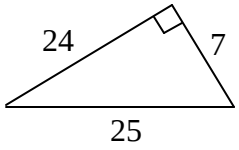
$\mathbf{a}^2 + \mathbf{b}^2 = \mathbf{c}^2$ means that a leg squared plus a leg squared is equal to the hypotenuse squared.

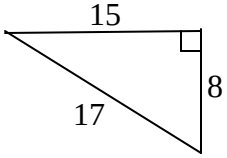
In triangle ABC above, $(AB)^2 + (AC)^2 = (BC)^2$.

There are certain ratios known as Pythagorean triples. Memorize these four and be able to apply them.
3-4-5, 5-12-13, 7-24-25, 8-15-17









Multiples of these ratios also work. For example, some multiples of 3-4-5 are 6-8-10 and 15-20-25.

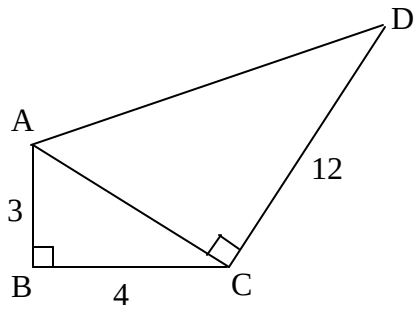
#21

The Pythagorean Theorem and Special Right Triangles Continued

Knowing four Pythagorean triples (3-4-5, 5-12-13, 7-24-25, 8-15-17) is helpful because you can solve some SAT questions without the time consuming math involved in using the Pythagorean theorem.

Notice how easy the following problem is if you know the triples.

Given the information in the diagram, what is the length of $\overline{AD}$.

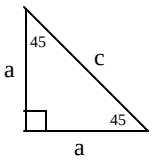


AD = 13 because AC = 5. There is a 3-4-5 triangle and a 5-12-13 triangle.

In addition to the four Pythagorean triples, you should know about two special right triangles. These are the 45°-45°-90° right triangle and the 30°-60°-90° right triangle.

In a **45°-45°-90°** right triangle, or a right isosceles triangle, the hypotenuse is equal to a leg times the square root of 2.

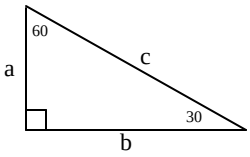
In the diagram to the right of a 45°-45°-90° right triangle, each of the legs is represented by **a** and the hypotenuse is represented by **c**.



$$c = a\sqrt{2}$$

In a **30°-60°-90°** right triangle, there are two relationships that are helpful to remember. The hypotenuse is equal to twice the smaller leg. The longer leg is equal to the shorter leg times the square root of 3.

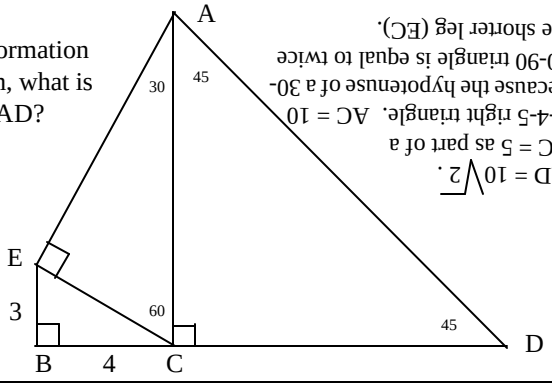
In the diagram to the right of a 30°-60°-90° right triangle, the shorter leg is represented by **a**, the longer leg is represented by **b**, and the hypotenuse is represented by **c**.



$$c = 2a$$
$$b = a\sqrt{3}$$

If you know the Pythagorean triples and the relationships of the sides of the 45°-45°-90° right triangle and the 30°-60°-90° right triangle, you might be able to do the question to the right in your head.

Given the information in the diagram, what is the length of AD?

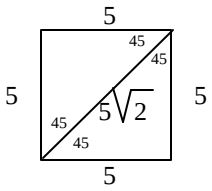


AD = $10\sqrt{2}$.
EC = 5 as part of a 3-4-5 right triangle. AC = 10 because the hypotenuse of a 30-60-90 triangle is equal to twice the shorter leg (EC).

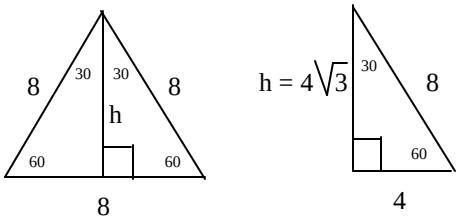
#21 The Pythagorean Theorem and Special Right Triangles Continued

The following are two common uses of the relationships of the sides of 45°-45°-90° right triangle and the 30°-60°-90° right triangle.

The diagonal of a square creates two 45°-45°-90° right triangles. The diagonal of the square is the hypotenuse of each of the 45°-45°-90° right triangles. If a side of the square is 5, then the diagonal of the square is $5\sqrt{2}$.



The altitude (h) of an equilateral triangle creates two 30°-60°-90° right triangles. The altitude is opposite a 60° angle and is equal to half the hypotenuse times the square root of 3.



1. Page 292 #20
2. Page 348 #6
3. Page 500 #22
4. Page 508 #8
5. Page 586 #21
6. Page 452 #16
7. Page 408 #25
8. Page 612 #25

#22 Circles

Formulas for Circumference

$C = \pi d$ $C = 2\pi r$

Formula for Area

$A = \pi r^2$

360 is an important number to remember with regard to circles.

The sum of the degrees of all of the arcs of a circle is 360°. The sum of the measures of all of the central angles of a circle is 360°.

1. Page 507 #3
2. Page 523 #3
3. Page 546 #2
4. Page 291 #14
5. Page 325 #9
6. Page 349 #9
7. Page 373 #19
8. Page 384 #20
9. Page 390 #6
10. Page 465 #22
11. Page 573 #9
12. Page 575 #19
13. Page 592 #4
14. Page 609 #11
15. Page 610 #18
16. Page 420 #25
17. Page 431 #9
18. Page 576 #25
19. Page 312 #9
20. Page 328 #25
21. Page 488 #25
22. Page 549 #10
23. Page 638 #10

#23 Volume

1. Page 339 #21
2. Page 499 #20
3. Page 451 #13
4. Page 509 #10

#24 Fractions

Fractions frighten many fine students, yet fractions will be your friends if you remember these three magic words: **Write it horizontally**

This means that if you have a fraction divided by a fraction, a fraction divided by a whole number, or a whole number divided by a fraction, rewrite the problem horizontally.

fraction over fraction

$$\frac{\frac{1}{2}}{\frac{3}{4}} = \frac{1}{2} \div \frac{3}{4} = \left(\frac{1}{2}\right)\left(\frac{4}{3}\right) = \mathbf{\frac{2}{3}}$$

fraction over whole number

$$\frac{\frac{3}{4}}{9} = \frac{3}{4} \div \frac{9}{1} = \left(\frac{3}{4}\right)\left(\frac{1}{9}\right) = \mathbf{\frac{1}{12}}$$

whole number over fraction

$$\frac{6}{\frac{3}{4}} = \frac{6}{1} \div \frac{3}{4} = \left(\frac{6}{1}\right)\left(\frac{4}{3}\right) = \mathbf{8}$$

The following problems involve fractions.

1. Page 291 #17
2. Page 369 #1
3. Page 404 #5
4. Page 449 #2
5. Page 290 #13
6. Page 338 #17
7. Page 373 #18
8. Page 484 #8

#25 Time

1. Page 483 #4
2. Page 408 #21
3. Page 592 #5

#26 Symbols or Letters in Multiplication and Addition

1. Page 429 #2
2. Page 573 #11
3. Page 340 #22

#27 Logic

1. Page 323 #2
2. Page 389 #2
3. Page 593 #7
4. Page 593 #8
5. Page 390 #4
6. Page 470 #5
7. Page 486 #17 (see#16 first)
8. Page 499 #21
9. Page 574 #16
10. Page 611 #20
11. Page 636 #5
12. Page 385 #24
13. Page 408 #24
14. Page 549 #8
15. Page 637 #8
16. Page 312 #10
17. Page 488 #24

#28 Word Problems

1. Page 309 #2
2. Page 323 #1
3. Page 323 #3
4. Page 347 #4
5. Page 371 #8
6. Page 389 #1
7. Page 538 #16
8. Page 622 #17
9. Page 324 #6
10. Page 325 #10
11. Page 404 #6
12. Page 419 #19
13. Page 470 #4
14. Page 572 #7
15. Page 304 #20
16. Page 372 #16
17. Page 464 #20
18. Page 507 #5
19. Page 540 #23
20. Page 624 #24
21. Page 391 #8
22. Page 488 #25