

PSAT prep

<https://pfrisbie.com/psat-prep/> Go there now.

What I hope to help you do in this class:

- Figure out what you personally need to work on
- Improve your competence at things you already know, but make mistakes on
- Learn some more efficient ways to solve problems, to get them right more quickly
- Identify whether you should use Desmos on a problem
- Use Desmos to its fullest advantage — there is a LOT that Desmos can do, and unless you have invested way more time learning how to use it than I suspect, there are many things I can teach you to help you exploit it for more correct answers

While my expertise is math, I can probably also help a bit with the reading and writing, if you have questions.

My qualifications:

- Spent 38 years teaching high school math, including to quite a few students who have excelled on this exam
- Named a National Merit Finalist way back in the 1900s
- Hit NMSQT qualifying scores on every one of the 10 practice PSAT and SAT tests on Bluebook (in Florida, the most recent qualifying score was 219; nationwide, the highest was 225*)
- Worked hundreds of practice problems this summer (every medium and hard problem in four different SAT math prep books, plus those in 10 Bluebook practice exams)
- Reported errors in every one of those books that have subsequently been addressed by their authors

*<https://ivytp.com/national-merit-scholarship-cutoff/>

Jury duty...

The reason I asked you to complete the practice PSAT 1 is that with that question-by-question data, I can pinpoint which techniques you would get the biggest gains from, and which topics I can most quickly bring you up to speed on.

Unfortunately, as I type this on Sunday, only 7 of you have submitted results; I have just learned that this may be related to my e-mails not getting through.

However, and importantly, all seven of those people had to submit more than once to get what I asked for originally.

This has shown me that 100% of you are likely to improve your scores if you read more carefully. Seriously. When I make errors on PSAT and SAT math questions, it is invariably because I wasn't reading carefully enough. Given that not a single person followed the instructions for getting a report exactly as they were presented on the first try, all of you are likely to improve your scores by reading more carefully.

Update Monday morning: I've now had attempts at submission by 10 people. The success rate on the first try has not improved.

More than one of you indicated that you want to focus on geometry and trig — presumably you feel less confident about that, and it is the category in which you collectively had the lowest percentage of questions answered correctly.

PSAT practice test 1			Mean % right
Algebra			71.1%
Advanced Math			68.3%
Problem-Solving and Data Analysis			78.9%
Geometry and Trigonometry			62.2%

However, if we look at your most commonly missed type of question, it's "Advanced Math."

How can that be true?

Index	Module	Question	Type	Answer	Responses	% correct	A	B	C	D	X	SP correct	SP wrong	Math Area
41	2H	19	Multiple-choice	B	8	0.00%	0	0	7	1	0			Algebra
42	2H	20	Multiple-choice	A	8	0.00%	0	4	3	0	1			AdvancedMath
43	2H	21	Multiple-choice	D	8	0.00%	3	1	4	0	0			Geometry
44	2H	22	Student-produced	0.0625	8	0.00%						0	8	AdvancedMath
22	1	22	Multiple-choice	B	9	33.33%	2	3	2	2	0			AdvancedMath
39	2H	17	Student-produced	0.5	8	37.50%						3	5	DataAnalysis
21	1	21	Student-produced	-7	9	44.44%						4	5	AdvancedMath
30	2H	8	Multiple-choice	B	8	50.00%	0	4	3	1	0			Algebra
37	2H	15	Multiple-choice	C	8	50.00%	1	2	4	0	1			Algebra
40	2H	18	Multiple-choice	B	8	50.00%	0	4	0	4	0			Geometry

It's because geometry and trig is the least common type of question on the tests the College Board has published. There were 5 geometry/trig questions on that practice test, and 14 advanced math.

What they say about the PSAT and SAT percentages in general is this:

PSAT/NMSQT

Algebra $\approx 35\%$

Advanced Math $\approx 32.5\%$

Problem-Solving and Data Analysis $\approx 20\%$

Geometry and Trigonometry $\approx 12.5\%$

SAT

Algebra $\approx 35\%$

Advanced Math $\approx 35\%$

Problem-Solving and Data Analysis $\approx 15\%$

Geometry and Trigonometry $\approx 15\%$

<https://satsuite.collegeboard.org/k12-educators/about/alignment/math>

2. Advanced Math

<https://satsuite.collegeboard.org/in-school-assessments/whats-on-the-test/psat-nmsqt/math>

Questions in this domain measure skills and knowledge central for progression to more advanced math courses, including demonstrating an understanding of absolute value, quadratic, exponential, polynomial, rational, radical, and other nonlinear equations. Questions include:

- Equivalent expressions
- Nonlinear equations in 1 variable and systems of equations in 2 variables
- Nonlinear functions

And this is what I have counted on the practice tests myself:

PSAT practice test 1		Count	Percent
Algebra		15	34.1%
Advanced Math		14	31.8%
Problem-Solving and Data Analysis		10	22.7%
Geometry and Trigonometry		5	11.4%

PSAT practice tests 1 and 2		Count	Percentage
Algebra		30	34.1%
Advanced Math		29	33.0%
Problem-Solving and Data Analysis		19	21.6%
Geometry and Trigonometry		10	11.4%
SAT practice tests 4-11			
Algebra		119	33.8%
Advanced Math		115	32.7%
Problem-Solving and Data Analysis		61	17.3%
Geometry and Trigonometry		57	16.2%
All combined			
Algebra		149	33.9%
Advanced Math		144	32.7%
Problem-Solving and Data Analysis		80	18.2%
Geometry and Trigonometry		67	15.2%

So while we won't ignore geometry and trig, it's far more important that you're strong in the advanced math that clearly is something you have spent fewer years learning than the algebra section — Advanced Math and Algebra categories account for more than 2/3 of the math questions.

Index	Module	Question	Type	Answer	Responses	% correct	A	B	C	D	X	SP correct	SP wrong	Math Area
41	2H	19	Multiple-choice	B	6	0.00%	0	0	5	1	0			Algebra

Math: Question 19

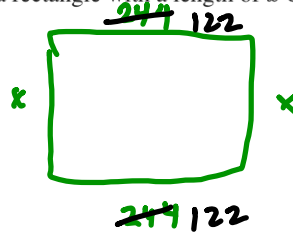
The given function f represents the perimeter, in centimeters (cm), of a rectangle with a length of x cm and a fixed width. What is the width, in cm, of the rectangle?

2
122
244
488

Perimeter

$$x + 244 + x + 244 = 2x + 488$$

$$f(x) = 2x + 244$$



Can Desmos make this easier?

Only if you know that the perimeter of a rectangle is $2L + 2W$.

$$2x_1 + 2w = 2x_1 + 244$$

REGRESSION PARAMETERS

$$x_1 = 0$$

$$w = 122$$

STATISTICS

RESIDUALS

$$RMSE = 0$$

$$e_1$$

Answer

You selected answer B. The correct answer is B.

Rationale

Choice B is correct. It's given that $f(x) = 2x + 244$ represents the perimeter, in centimeters (cm), of a rectangle with a length of x cm and a fixed width. If w represents a fixed width, in cm, then the perimeter, in cm, of a rectangle with a length of x cm and a fixed width of w cm can be given by the function $f(x) = 2x + 2w$. Therefore, $2x + 2w = 2x + 244$. Subtracting $2x$ from both sides of this equation yields $2w = 244$. Dividing both sides of this equation by 2 yields $w = 122$. Therefore, the width, in cm, of the rectangle is 122.

Choice A is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

Index	Module	Question	Type	Answer	Responses	% correct	<	=	>	U	D	X	SP correct	SP wrong	Math Area
42	2H	20	Multiple-choice		6	0.00%	0	4	2	0	0	0			AdvancedMath

Math: Question 20

$$f(x) = |59 - 2x| \quad f(k) = |59 - 2k|$$

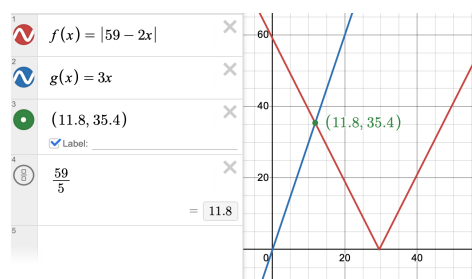
The function f is defined by the given equation. For which of the following values of k does $f(k) = 3k$?

- A. $\frac{59}{5}$
 B. $\frac{59}{2}$
 C. $\frac{177}{5}$
 D. 59

$$|59 - 2k| = 3k$$

Can Desmos make this easier?

Yes; you can graph or use a regression.



Answer

You selected answer A. The correct answer is A.

Rationale

Choice A is correct. The value of k for which $f(k) = 3k$ can be found by substituting k for x and $3k$ for $f(x)$ in the given equation, $f(x) = |59 - 2x|$, which yields $3k = |59 - 2k|$. For this equation to be true, either $-3k = 59 - 2k$ or $3k = 59 - 2k$. Adding $2k$ to both sides of the equation $-3k = 59 - 2k$ yields $-k = 59$. Dividing both sides of this equation by -1 yields $k = -59$. To check whether -59 is the value of k , substituting -59 for k in the equation $3k = |59 - 2k|$ yields $3(-59) = |59 - 2(-59)|$, which is equivalent to $-177 = |177|$, or $-177 = 177$, which isn't a true statement. Therefore, -59 isn't the value of k . Adding $2k$ to both sides of the equation $3k = 59 - 2k$ yields $5k = 59$. Dividing both sides of this equation by 5 yields $k = \frac{59}{5}$. To check whether $\frac{59}{5}$ is the value of k , substituting $\frac{59}{5}$ for k in the equation $3k = |59 - 2k|$ yields $3\left(\frac{59}{5}\right) = |59 - 2\left(\frac{59}{5}\right)|$, which is equivalent to $\frac{177}{5} = \left|\frac{177}{5}\right|$, or $\frac{177}{5} = \frac{177}{5}$, which is a true statement. Therefore, the value of k for which $f(k) = 3k$ is $\frac{59}{5}$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Choice D is incorrect and may result from conceptual or calculation errors.

$$|59 - 2x| = 3x \quad \text{if } x = -59, \quad 3x = -177 \quad \text{extraneous solution}$$

$$59 - 2x = 3x$$

$$59 - 5x$$

$$\frac{59}{5} = x$$

OR

$$59 - 2x = -3x$$

$$59 = -x$$

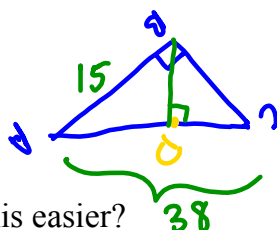
$$x = -59$$

Index	Module	Question	Type	Answer	Responses	% correct	A	B	C	D	X	SP correct	SP wrong	Math Area
43	2H	21	Multiple-choice	D	6	0.00%	3	0	3	0	0	0	0	Geometry

Math: Question 21

In triangle ABC , the measure of angle B is 90° and $\overline{BD}$ is an altitude of the triangle. The length of $\overline{AB}$ is 15 and the length of $\overline{AC}$ is 23 greater than the length of $\overline{AB}$. What is the value of $\frac{BC}{BD}$?

- A. $\frac{15}{38}$
 B. $\frac{15}{23}$
 C. $\frac{23}{15}$
 D. $\frac{38}{15}$



$$23 + 15 = 38$$

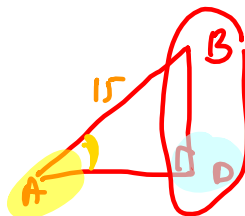
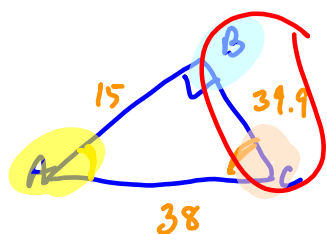
$$\frac{39.9}{13.78} = \frac{BC}{BD}$$

$$BC^2 + AB^2 = AC^2$$

$$BC = \sqrt{38^2 - 15^2}$$

Can Desmos make this easier?

Not really. You should draw a diagram and set up the ratio. $BC \approx 34.9$



$$\frac{BD}{BC} = \frac{30}{34.9} = \frac{15}{39}$$

$$BD = 13.78$$

$$\triangle ABC \sim \triangle ADB \sim \triangle BDC$$

Answer

You selected answer D. The correct answer is D.

Rationale

Choice D is correct. It's given that in triangle ABC , the measure of angle B is 90° and $\overline{BD}$ is an altitude of the triangle. Therefore, the measure of angle BDC is 90° . It follows that angle B is congruent to angle D and angle C is congruent to angle C . By the angle-angle similarity postulate, triangle ABC is similar to triangle BDC . Since triangles ABC and BDC are similar, it follows that $\frac{AC}{AB} = \frac{BC}{BD}$. It's also given that the length of $\overline{AB}$ is 15 and the length of $\overline{AC}$ is 23 greater than the length of $\overline{AB}$. Therefore, the length of $\overline{AC}$ is $15 + 23$, or 38. Substituting 15 for AB and 38 for AC in the equation $\frac{AC}{AB} = \frac{BC}{BD}$ yields $\frac{38}{15} = \frac{BC}{BD}$. Therefore, the value of $\frac{BC}{BD}$ is $\frac{38}{15}$.

Choice A is incorrect. This is the value of $\frac{BD}{BC}$.

Choice B is incorrect and may result from conceptual or calculation errors.

Choice C is incorrect and may result from conceptual or calculation errors.

Index	Module	Question	Type	Answer	Responses	% correct
44	2H	22	Student-produced		6	0.00%

Math: Question 22

$$64x^2 - (16a + 4b)x + ab = 0$$

In the given equation, a and b are positive constants. The sum of the solutions to the given equation is $k(4a + b)$, where k is a constant. What is the value of k ?

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses
22	1	22	Multiple-choice		7

Math: Question 22

$$f(x) = \frac{a-19}{x} + 5$$

In the given function f , a is a constant. The graph of function f in the xy -plane, where $y = f(x)$, is translated 3 units down and 4 units to the right to produce the graph of $y = g(x)$. Which equation defines function g ?

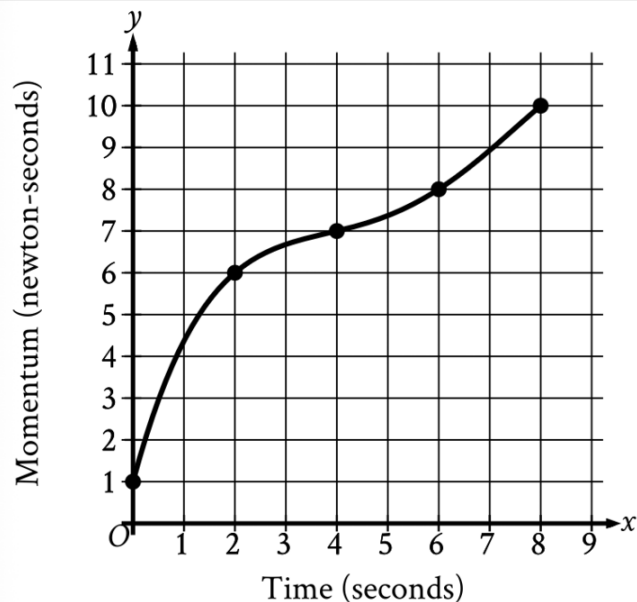
- A. $g(x) = \frac{a-19}{x+4} + 2$
- B. $g(x) = \frac{a-19}{x-4} + 2$
- C. $g(x) = \frac{a-22}{x+4} + 5$
- D. $g(x) = \frac{a-22}{x-4} + 5$

Can Desmos make this easier?



Index	Module	Question	Type	Answer	Responses	% correct
39	2H	17	Student-produced		6	16.67%

Math: Question 17



The graph shows the momentum y , in newton-seconds, of an object x seconds after the object started moving, for $0 \leq x \leq 8$. What is the average rate of change, in newton-seconds per second, in the momentum of the object from $x = 2$ to $x = 6$?

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses
21	1	21	Student-produced		7

Math: Question 21

$$f(x) = (x + 7)^2 + 4$$

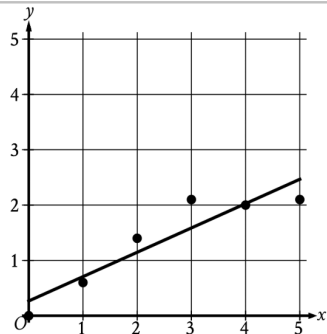
The function f is defined by the given equation. For what value of x does $f(x)$ reach its minimum?

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses
30	2H	8	Multiple-choice		6

Math: Question 8

The scatterplot shows the relationship between x and y . A line of best fit is also shown.



Which of the following is closest to the slope of the line of best fit shown?

- A. -2.27
- B. -0.44
- C. 0.44
- D. 2.27

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses	% correct
37	2H	15	Multiple-choice		8	50.00%

Math: Question 15

$$-15x + 25y = 65$$

One of the two equations in a system of linear equations is given. The system has infinitely many solutions. Which of the following could be the second equation in the system?

- A. $12x + 20y = 52$
- B. $12x + 20y = -52$
- C. $-12x + 20y = 52$
- D. $-12x + 20y = -52$

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses	% correct
40	2H	18	Multiple-choice		6	50.00%

Math: Question 9

Line k is defined by $y = \frac{1}{4}x + 1$. Line j is parallel to line k in the xy -plane. What is the slope of j ?

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses	% correct
10	1	10	Multiple-choice		7	57.14%

Math: Question 10

Which expression is a factor of $2x^2 + 38x + 10$?

- A. 2
- B. $5x$
- C. $38x$
- D. $2x^2$

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses	% correct
20	1	20	Multiple-choice		7	57.14%

Math: Question 20

$x + 3 = -2y + 5$

$x - 3 = 2y + 7$

The solution to the given system of equations is (x, y) . What is the value of $2x$?

- A. -2
- B. 6
- C. 12
- D. 24

Can Desmos make this easier?

Index	Module	Question	Type	Answer	Responses	% correct	A	B	C	D	X	SP correct	SP wrong	Math Area
41	2H	19	Multiple-choice	B	8	0.00%	0	0	7	1	0			Algebra
42	2H	20	Multiple-choice	A	8	0.00%	0	4	3	0	1			AdvancedMath
43	2H	21	Multiple-choice	D	8	0.00%	3	1	4	0	0			Geometry
44	2H	22	Student-produced	0.0625	8	0.00%						0	8	AdvancedMath
22	1	22	Multiple-choice	B	9	33.33%	2	3	2	2	0			AdvancedMath
39	2H	17	Student-produced	0.5	8	37.50%						3	5	DataAnalysis
21	1	21	Student-produced	-7	9	44.44%						4	5	AdvancedMath
30	2H	8	Multiple-choice	B	8	50.00%	0	4	3	1	0			Algebra
37	2H	15	Multiple-choice	C	8	50.00%	1	2	4	0	1			Algebra
40	2H	18	Multiple-choice	B	8	50.00%	0	4	0	4	0			Geometry

Monday morning, nine responses

Index	Module	Question	Type	Answer	Responses	% correct	A	B	C	D	X	SP correct	SP wrong	Math Area
41	2H	19	Multiple-choice	B	6	0.00%	0	0	5	1	0			Algebra
42	2H	20	Multiple-choice	A	6	0.00%	0	4	2	0	0			AdvancedMath
43	2H	21	Multiple-choice	D	6	0.00%	3	0	3	0	0			Geometry
44	2H	22	Student-produced	1/16, 0.0625	6	0.00%						0	6	AdvancedMath
39	2H	17	Student-produced	½, 0.5	6	16.67%						1	5	DataAnalysis
22	1	22	Multiple-choice	B	7	28.57%	1	2	2	2	0			AdvancedMath
21	1	21	Student-produced	-7	7	42.86%						3	4	AdvancedMath
30	2H	8	Multiple-choice	B	6	50.00%	0	3	2	1	0			Algebra
40	2H	18	Multiple-choice	B	6	50.00%	0	3	0	3	0			Geometry

Sunday morning, seven responses