NOVEMBER 7 · SAT MATH · PREDICTIONS

What I think shows up on November 7. All solved.

The questions I'd bet on for the November SAT, each one worked out step by step, the way I explain it in the video.



WATCH Tap the video to see me solve every one, start to finish.

HOW TO USE IT

Try each question **before** you scroll to my working. Getting it wrong first is what makes it stick.

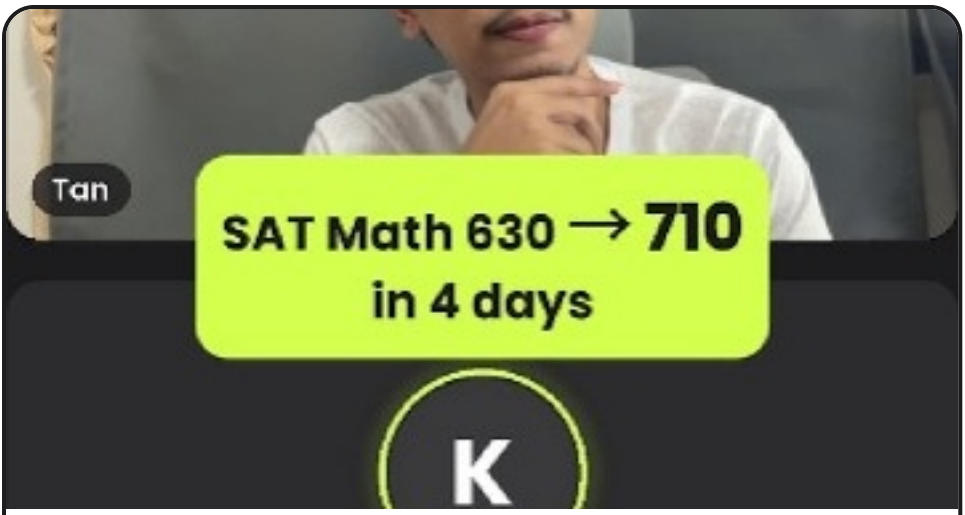


Hi, I'm Tan

In grade 4 I needed extra math every day. Then I got an 800.

In grade 4, I was so weak at math that my teacher kept me after school for extra lessons, **every single day**. That kid later taught himself to an SAT Math 800, and has spent the last two years tutoring students 1-on-1, from "what is 2 minus 5?" to 750s.

So **I get it**. Wherever math broke for you, we go back there and build up, **at your pace**.



630 → 710 in 4 days

"I never would've been able to do it without you."

Watch Keertana's testimonial →

A FEW STUDENTS WHO PUT THIS TO WORK

Shared with permission. Every score and quote below is real.

630 → 710

Keertana

“I just checked my score and hit 710 in math.” Four days of lessons before her test.

580 → 750

Mossy

“Thank you so much for teaching me so well, bro.” Stuck at 580–620 for months after a big-name prep course.

650 → 710

Alisa

“Hit my target, 710! You teach SO well.” Two weeks after we started.

01

PREDICTION 1 · ADVANCED MATH

Signs of f tell you where the roots are

$$f(x) = (x - a)(x - b)$$

The function f is defined by the given equation, where a and b are integer constants. If $f(39) > 0$, $f(42) < 0$, and $f(45) > 0$, which of the following could be the value of $a + b$?

A 42

B 44

C 81

D 83

Try it first. *My working is on the next page.*

01

MY WORKING · 1 OF 2

Signs of f tell you where the roots are

THE KEY IDEA

$(x-a)(x-b)$ is **factor form**: a and b are the x-intercepts. The sign of f tells you if a point is **above or below** the x-axis.

1. Factor form is $y = a(x-r_1)(x-r_2)$, where r_1 and r_2 are the x-intercepts. Here the number in front is 1, which is positive, so the parabola **opens upward**. Solving by hand is easier here, so sketch it.

2. Turn each fact into a point. $f(39) > 0$ means at $x = 39$, y is positive. $f(42) < 0$: y is negative. $f(45) > 0$: y is positive again.

$$(39, +) \qquad (42, -) \qquad (45, +)$$

3. Above the x-axis y is positive, under it y is negative. So 42 sits in the dip under the axis, and the curve crosses the axis once between 39 and 42, and once between 42 and 45. Those crossings are a and b.

$$39 < a < 42 \;\Rightarrow\; a = 40 \text{ or } 41$$

$$42 < b < 45 \;\Rightarrow\; b = 43 \text{ or } 44$$

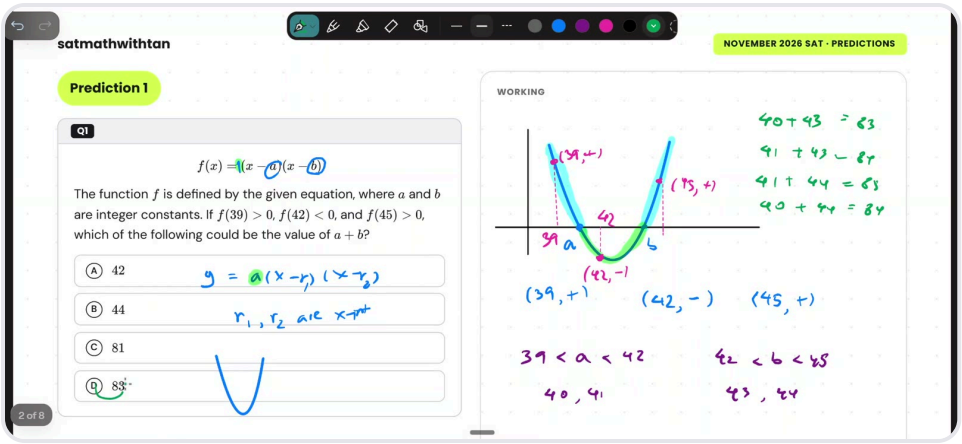
My working continues on the next page ↓

MY WORKING · 2 OF 2

01 Signs of f tell you where the roots are

4 Try every pair. $a + b$ can only be 83, 84 or 85. Only **83** is a choice.

$$40 + 43 = 83 \quad 41 + 43 = 84 \quad 41 + 44 = 85 \quad 40 + 44 = 84$$



FROM THE VIDEO My sketch: the three points, the dip under the axis, and every possible $a + b$.

THE TRAP

C, 81. That's $39 + 42$. But a and b can't *be* 39 or 42: f is positive or negative there, never 0. The intercepts sit strictly **between** them.

ANSWER **D. 83**

02

PREDICTION 2 · GEOMETRY AND TRIGONOMETRY

Angles from two crossing lines

Two lines intersect at exactly one point, forming two acute angles and two obtuse angles. The measure of one of these angles is $(9x - 140)^\circ$. Which of the following could NOT be the sum of the measures of any two of these angles?

A $(-18x + 280)^\circ$

B $(-18x + 640)^\circ$

C $(18x - 280)^\circ$

D 180°

Try it first. *My working is on the next page.*

02

MY WORKING · 1 OF 2

Angles from two crossing lines

THE KEY IDEA

Opposite (vertical) angles are **equal**. Angles next to each other on a straight line **add up to 180**.

1. Draw the two lines. The angle across from $(9x - 140)$ is also $9x - 140$, because opposite angles are equal.

2. Call the other angle y. It sits next to $9x - 140$ on a straight line, so they add up to 180. Write y in terms of x.

$$y + 9x - 140 = 180$$

$$y = 320 - 9x$$

3. Now add up any two angles and see what's possible. Two of the same small angles:

$$2(9x - 140) = 18x - 280 \quad \text{(C)}$$

4. One of each: always 180, they make a straight line. That's **D**. Two of the other angle:

$$2(320 - 9x) = 640 - 18x \quad \text{(B)}$$

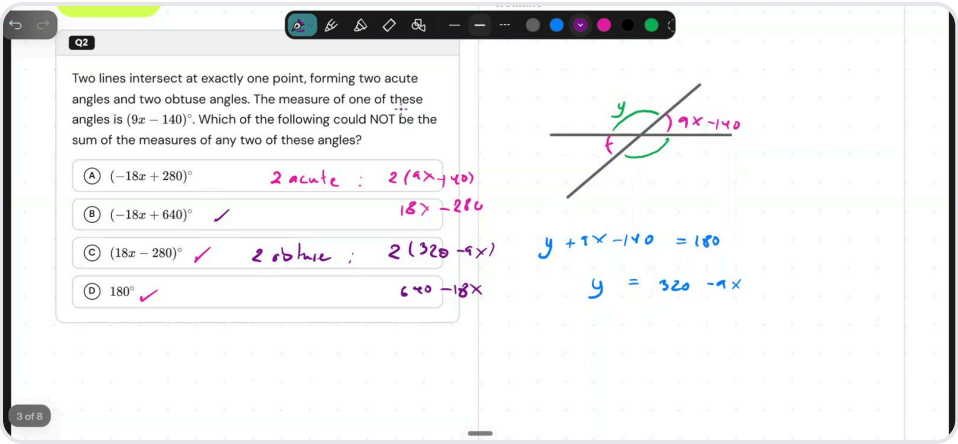
5. B, C and D can all happen. The one that can't is **A**.

My working continues on the next page ↓

02

MY WORKING · 2 OF 2

Angles from two crossing lines



FROM THE VIDEO The angles named, $y = 320 - 9x$, and every possible sum ticked off.

THE TRAP

A looks like C with the signs flipped, so it feels like it belongs. No pair of angles gives it. Check each pair, don't go by how it looks.

ANSWER **A.** $(-18x + 280)°$

03

PREDICTION 3 · ALGEBRA

Budget and a minimum: the candles

A small business owner budgets $2,200 to purchase candles. The owner must purchase a minimum of 200 candles to maintain the discounted pricing. If the owner pays $4.90 per candle to purchase small candles and $11.60 per candle to purchase large candles, what is the maximum number of large candles the owner can purchase to stay within the budget and maintain the discounted pricing?

Grid-in: you type the answer, there are no choices.

Try it first. *My working is on the next page.*

03

MY WORKING · 1 OF 2

Budget and a minimum: the candles

THE KEY IDEA

Two rules, two inequalities: one for **how many** candles, one for **the budget**. Graph both in Desmos and find the highest point of the overlap.

1. Let x be the number of small candles and y the number of large ones. **Minimum** 200 candles means at least 200: greater than or equal to.

$$x + y \geq 200$$

2. Budget: small ones cost \$4.90 each, large ones \$11.60 each, and the total can't go over \$2,200.

$$4.90x + 11.60y \leq 2200$$

3. Type both into Desmos. The answer lives in the overlap. x and y are numbers of candles, so they can't be negative: only look at the triangle on the right side of the y-axis. Its highest point is the most large candles.

$$(17.91,\ 182.09)$$

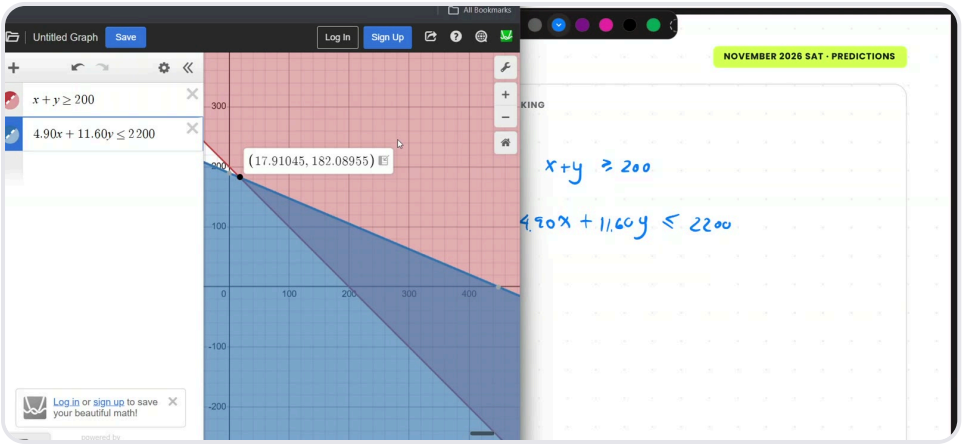
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03

MY WORKING · 2 OF 2

Budget and a minimum: the candles

4 You can't buy part of a candle, so **round down**: 182. With 183 large candles you go over the budget.



FROM THE VIDEO Both inequalities in Desmos. The top of the overlap is at $y = 182.08955$.

THE TRAP

183. Rounding 182.09 to the nearest whole number feels right, but 183 large candles costs more than \$2,200. A maximum always rounds **down**.

ANSWER **182**

04

PREDICTION 4 · ADVANCED MATH

Smallest b in a factor x + b

One of the factors of $2x^3 + 42x^2 + 208x$ is $x + b$, where b is a positive constant. What is the smallest possible value of b?

Grid-in: you type the answer, there are no choices.

Try it first. *My working is on the next page.*

04

MY WORKING · 1 OF 2

Smallest b in a factor x + b

THE KEY IDEA

Every polynomial can be written in **factor form**: $a(x-r_1)(x-r_2)(x-r_3)\ldots$, one bracket per degree.

1. **By hand.** Take out $2x$. Then find two numbers that multiply to 104 and add up to 21. (Stuck? Desmos can find them: graph $x+y=21$ and $xy=104$ and read where they meet: 8 and 13.)

$$2x^3+42x^2+208x=2x(x^2+21x+104)=2x(x+8)(x+13)$$

2. **With Desmos.** It's a cubic, so three brackets. Run a regression on the factor form. Don't forget to give x_1 random values.

$$x_1=\text{random}(10)$$

$$2x_1^3+42x_1^2+208x_1\sim a(x_1-r_1)(x_1-r_2)(x_1-r_3)$$

3. Desmos gives $r_1=0$, $r_2=-13$, $r_3=-8$. Or just graph the expression and click the x-intercepts: -13, -8, 0. Either way, **swap the sign** to get the factors. a is the leading coefficient, 2.

$$2(x-0)(x+8)(x+13)$$

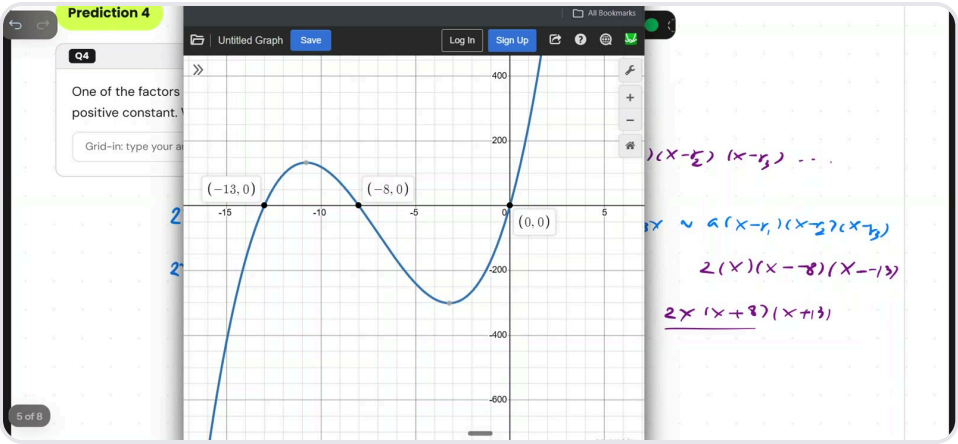
4. b is positive, so b is 8 or 13. The smallest is **8**.

My working continues on the next page ↓

04

MY WORKING · 2 OF 2

Smallest b in a factor x + b



FROM THE VIDEO The graph's x-intercepts are -13, -8 and 0. Flip the signs: $(x + 13)(x + 8)\,x$.

THE TRAP

-8 **or** -13**.** Those are the x-intercepts, not the b in $x + b$. Flip the sign. And 13 is a factor too, just not the smallest one.

ANSWER **8**

05

PREDICTION 5 · PROBLEM-SOLVING AND DATA ANALYSIS

The missing number in data set A

Data set A consists of 10 positive integers less than 60. The list shown gives 9 of the integers from data set A.

$$43,\ 45,\ 44,\ 43,\ 38,\ 39,\ 40,\ 46,\ 40$$

The mean of these 9 integers is 42. If the mean of data set A is an integer that is greater than 42, what is the value of the largest integer from data set A?

Grid-in: you type the answer, there are no choices.

Try it first. *My working is on the next page.*

05

MY WORKING · 1 OF 2

The missing number in data set A

THE KEY IDEA

Call the missing tenth number x_1, put all ten into **mean()** in Desmos, and move a slider until both rules are true.

1. Data set A has 10 integers and we're given 9. Call the 10th one x_1. Write down the two rules: the mean of all 10 is an **integer**, and it's **greater than 42**.

2. Type the mean into Desmos with all ten numbers.

$$\text{mean}(43, 45, 44, 43, 38, 39, 40, 46, 40, x_1)$$

3. Make x_1 a slider. It's a positive integer less than 60, so set the **step to 1** and the top to 60.

4. Slide up. At $x_1 = 42$ the mean is exactly 42: not greater. Keep going until the mean is a whole number again: $x_1 = 52$ gives a mean of **43**. Both rules work, and 52 is less than 60.

$$x_1 = 52 \;\Rightarrow\; \text{mean} = 43$$

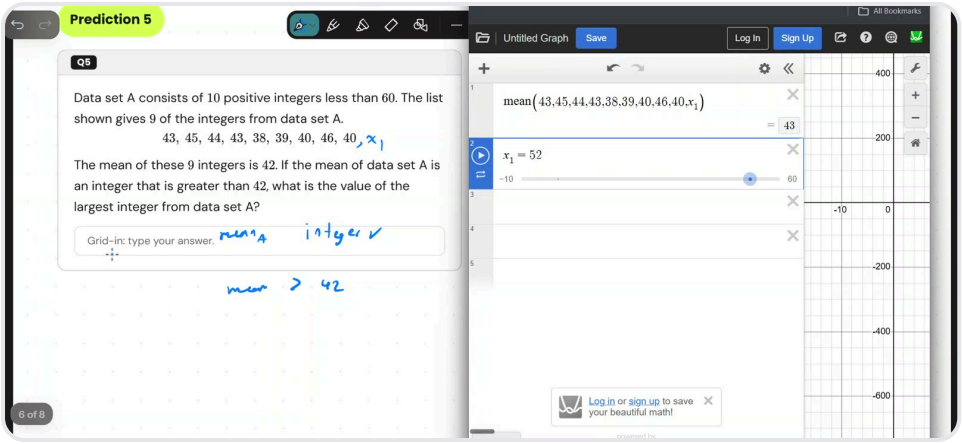
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05

MY WORKING · 2 OF 2

The missing number in data set A

5 Is there a second answer? The next whole-number mean, 44, needs $x_1 = 62$, and we can't go above 60. So the missing number is 52, and it's also the largest in the set.



FROM THE VIDEO x_1 as a slider with step 1: at $x_1 = 52$ the mean is 43.

THE TRAP

42. At $x_1 = 42$ the mean is 42, and the question wants a mean **greater than** 42. Read the inequality, not just the number.

ANSWER **52**

06

PREDICTION 6 · GEOMETRY AND TRIGONOMETRY

Isosceles right triangle perimeter

An isosceles right triangle has a hypotenuse of length 58 inches. What is the perimeter, in inches, of this triangle?

(A) $29\sqrt{2}$

(B) $58\sqrt{2}$

(C) $58 + 58\sqrt{2}$

(D) $58 + 116\sqrt{2}$

Try it first. *My working is on the next page.*

06

MY WORKING · 1 OF 2

Isosceles right triangle perimeter

THE KEY IDEA

Isosceles right triangle: the **two legs are equal**. Pythagoras finds a leg, then add up all three sides.

1. Draw it. Isosceles means the two legs are equal, so call each one x. The hypotenuse is 58.

2. It's a right triangle, so use Pythagoras: $a^2 + b^2 = c^2$. Both legs are x. In Desmos use x_1 and the **~** so it solves for you.

$$x_1^2 + x_1^2 \sim 58^2 \;\Rightarrow\; x_1 = 41.01$$

3. The perimeter is all three sides.

$$x_1 + x_1 + 58 = 140.02$$

4. Type the choices in and see which one matches. A, no. B is 82.02, no. C, $58 + 58\sqrt{2}$, is **140.02**. That's it.

5. Or use the special right triangle on the reference sheet (45-45-90): each leg is the hypotenuse divided by $\sqrt{2}$, so $29\sqrt{2}$.

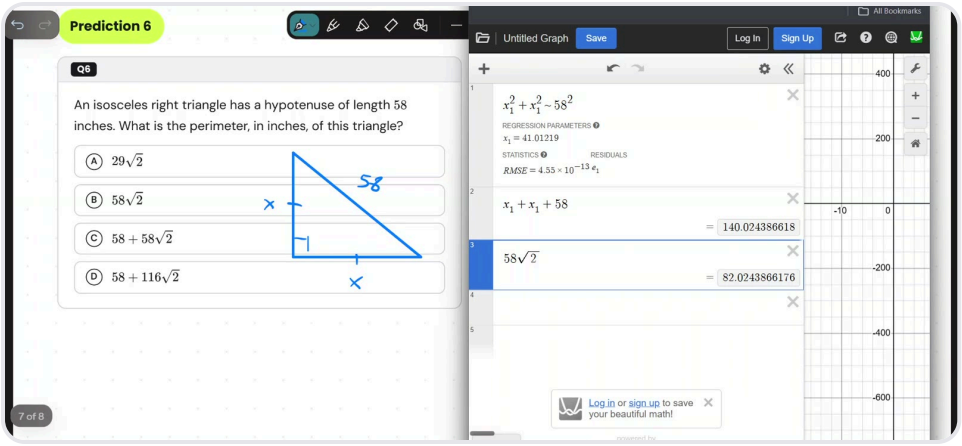
$$29\sqrt{2} + 29\sqrt{2} + 58 = 58 + 58\sqrt{2}$$

My working continues on the next page ↓

06

MY WORKING · 2 OF 2

Isosceles right triangle perimeter



FROM THE VIDEO Pythagoras as a regression, the perimeter, then matching the choices.

THE TRAP

A, $29\sqrt{2}$**.** That's one leg, not the perimeter. And B, $58\sqrt{2}$, is the two legs without the hypotenuse.

ANSWER **C.** $58+58\sqrt{2}$

07

PREDICTION 7 · GEOMETRY AND TRIGONOMETRY

Circle radius written as np

$$8x^2 + 112px + 8y^2 - 64py = -448p^2$$

In the xy-plane, the graph of the given equation is a circle. The length of the radius of the circle is np, where n and p are positive constants. What is the value of n?

Grid-in: you type the answer, there are no choices.

Try it first. *My working is on the next page.*

07

MY WORKING · 1 OF 2

Circle radius written as np

THE KEY IDEA

The question never asks for p. So **make p up**. Pick $p = 1$ and the radius **is** n.

1. Type the equation into Desmos as it is.

$$8x^2 + 112px + 8y^2 - 64py = -448p^2$$

2. Desmos needs a value for p, but the question only wants n. p is any positive constant, so choose $p = 1$. Then the radius is $n \times 1$, which is just n.

$$r = np = n(1) = n$$

3. Find the radius. Put a point at the top and the bottom of the circle, call them a and b. The distance between them is the **diameter**, so divide by 2.

$$\frac{\text{distance}(a, b)}{2} = 3$$

4. Radius 3 with $p = 1$, so $n = 3$. Want to check it? Try $p = 2$: the radius comes out 6, and $6 = n(2)$ still gives $n = 3$.

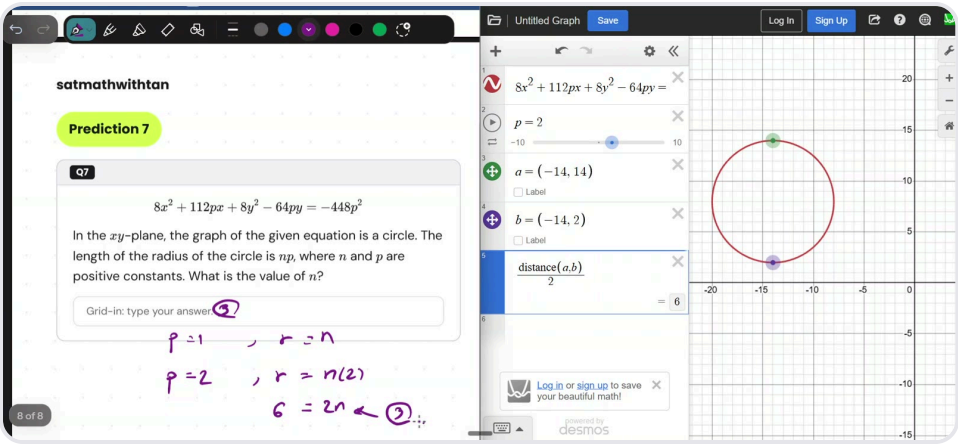
$$p = 2 : \ 6 = 2n \ \Rightarrow \ n = 3$$

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07

MY WORKING · 2 OF 2

Circle radius written as np



FROM THE VIDEO With $p = 2$ the radius is 6. Since $r = np$, $6 = 2n$ and $n = 3$.

THE TRAP

6. That's the radius when $p = 2$, not n. And don't stop at the distance between the points: that's the diameter. Divide by 2.

ANSWER **3**

ANSWER KEY

01	Signs of f tell you where the roots are	**D. 83**
02	Angles from two crossing lines	**A.** $(-18x + 280)^\circ$
03	Budget and a minimum: the candles	**182**
04	Smallest b in a factor x + b	**8**
05	The missing number in data set A	**52**
06	Isosceles right triangle perimeter	**C.** $58 + 58\sqrt{2}$
07	Circle radius written as np	**3**

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