CURRIFORGE

DEMONSTRATION SET · SAMPLE

# Digital SAT Mathematics

Five-item demonstration set

ALGEBRA · ADVANCED MATH · PROBLEM-SOLVING & DATA ANALYSIS · GEOMETRY & TRIG

DESMOS-FIRST SOLUTIONS WITH ALGEBRAIC ALTERNATIVES · VERIFIED KEYS · DIFFICULTY TAGGED

HOW THIS SET WAS FORGED

# Struck twice, checked line by line.

Nothing in this set left the forge on a single pass. Every item was written, then independently re-solved before the answer key was opened.

## Independent re-solve

Keys are confirmed by agreement between two blind solves, not by trust.

## Severity-tiered flagging

Findings are graded so you see instantly what must change, what should change, and what is style:

RED FLAG CAUTION NOTE

## Corrections, not comments

Every flag ships with a copy-paste-ready fix. Your team pastes, they do not decode.

## AI drafted, human verified

AI-generated items get the same treatment: stress-tested line by line for the logic errors and hallucinated keys that models miss.

IN THIS SET

Five hard-tier items: a system with no solution, a quadratic minimum, graph-to-system matching, a circle-inscribed rectangle, and conditional probability. Each solution leads with the Desmos route used on the live exam, then gives the full algebraic alternative.

*The pages that follow are working output in the exact format clients receive, watermarked as a sample. Intellectual property in commissioned work transfers fully to the client on final payment.*

| Q-1 | #Ha... | #Algebra | #Systems of two linear e... |
|---|---|---|---|

In the system below, m is a constant:

$$\frac{7}{3}x + 2 = \frac{5}{6}y - \frac{1}{3}x$$

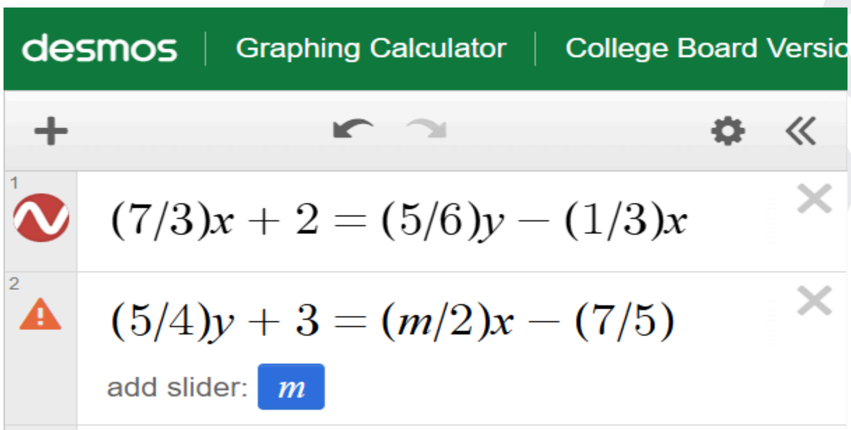
$$\frac{5}{4}y + 3 = \frac{m}{2}x - \frac{7}{5}$$

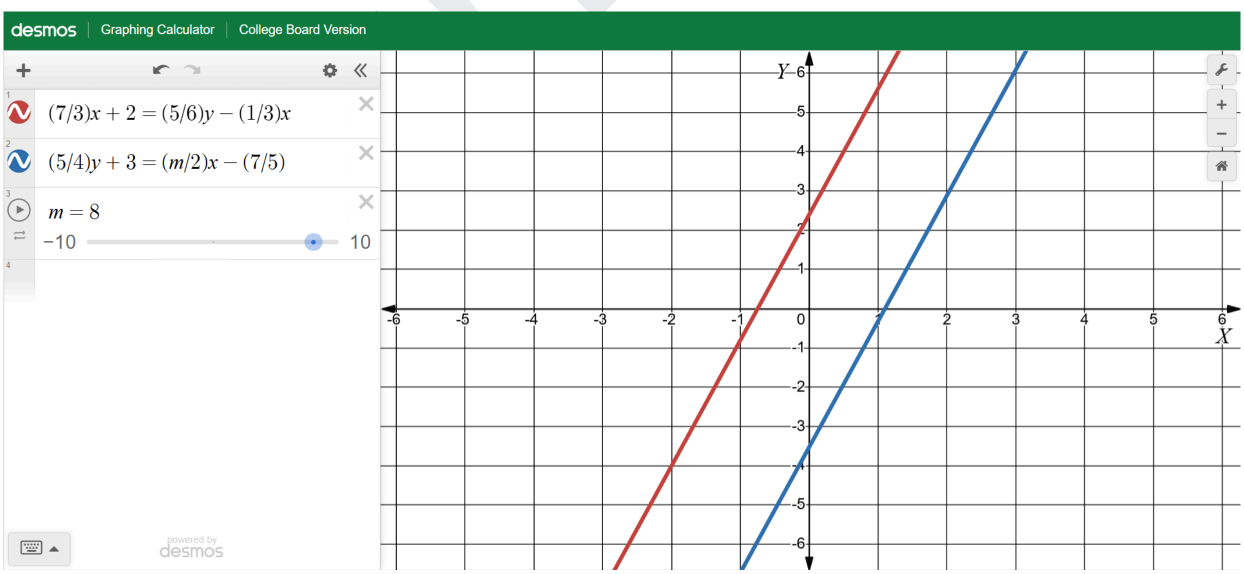
If the system has no solution, what is the value of m?

| Correct Answer | 8 |
|---|---|

**Solution:**

Using Desmos to Find "No Solution"




To find the value of a constant (m) that makes a system of equations have no solution, you can use the Desmos graphing calculator to avoid messy algebra. Remember, "no solution" means the lines are **parallel**.

Here's the process:

1. **Enter the Equations:** Type both equations into the Desmos calculator exactly as they appear, using x and y for the variables.

Equation 1:

$$\frac{7}{3}x + 2 = \frac{5}{6}y - \frac{1}{3}x$$

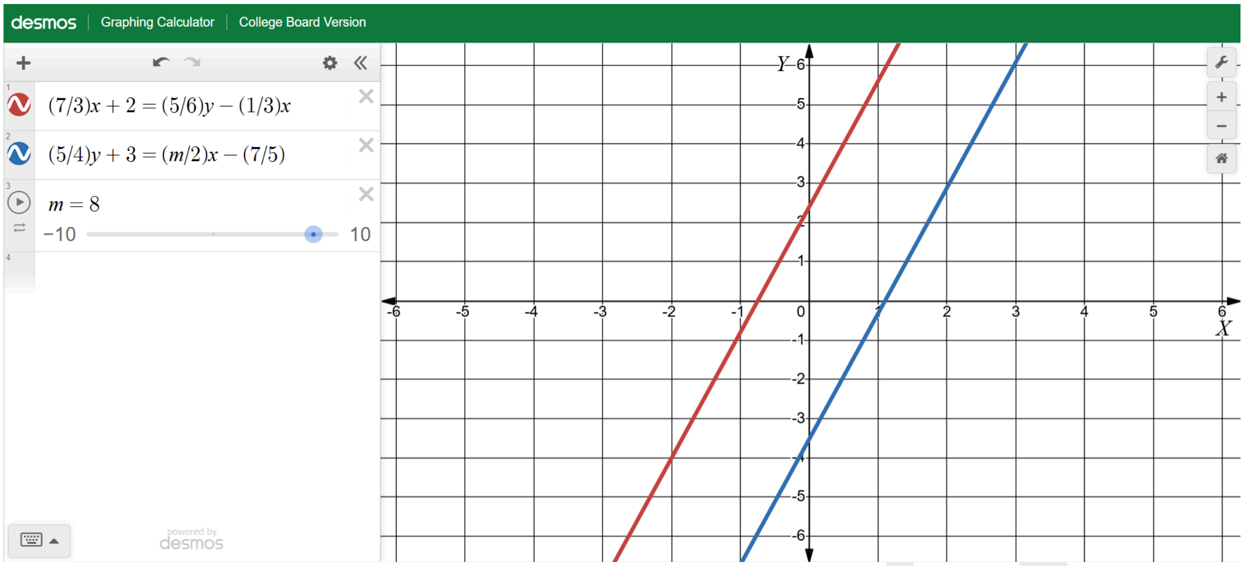
Equation 2:

$$\frac{5}{4}y + 3 = \frac{m}{2}x - \frac{7}{5}$$

**2. Add a Slider:** When you type the unknown constant (m), Desmos will prompt you to "add slider". Click on it.

**3. Find the Parallel Point:** Adjust the slider for `m` and watch the graph change in real-time. The goal is to find the exact value where the two lines become parallel, running in the same direction without ever touching.

The value on the slider at that moment is your answer. For example, if the lines become parallel when the slider is at **m = 8**, then 8 is the value that results in no solution.




Final Answer: m = 8
Tip:
When you're asked about "no solution" or "infinitely many solutions," think of the graph. Desmos lets you see when lines are parallel or overlapping.

**Alternative Algebraic solution:**

"No solution" means the two lines are parallel but not the same, so their slopes must match and their intercepts must differ.

1. Put Equation 1 in slope–intercept form.

$$\frac{7}{3}x + 2 = \frac{5}{6}y - \frac{1}{3}x$$

$$\left(\frac{7}{3} + \frac{1}{3}\right)x + 2 = \frac{5}{6}y$$

$$\frac{8}{3}x + 2 = \frac{5}{6}y$$

Multiply by 6: $16x + 12 = 5y$

$$y = \frac{16}{5}x + \frac{12}{5}$$

So $\text{slope}_1 = \frac{16}{5}$.

2. Put Equation 2 in slope–intercept form.

$\frac{5}{4}y + 3 = \frac{m}{2}x - \frac{7}{5}$

$\frac{5}{4}y = \frac{m}{2}x - \frac{22}{5}$

$y = \frac{2m}{5}x - \frac{88}{25}$

Slope$_2$ = $\frac{2m}{5}$.

3. Parallel condition (equal slopes):

$\frac{16}{5} = \frac{2m}{5}$

16 = 2m

m = 8.

4. Not the same line check (different intercepts):

From the forms above, $b_1 = \frac{12}{5}$ and $b_2 = -\frac{88}{25}$, which are not equal, so the lines are distinct.

| Q-2 | #Hard | #Advanced M... | #Nonlinear functions |
|---|---|---|---|

Find the least value attained by the following function
$h(n) = 5n^2 - 70n + 1{,}135$

| Correct Answer | 890 |
|---|---|

**Solution:**

**Correct Answer:** 890

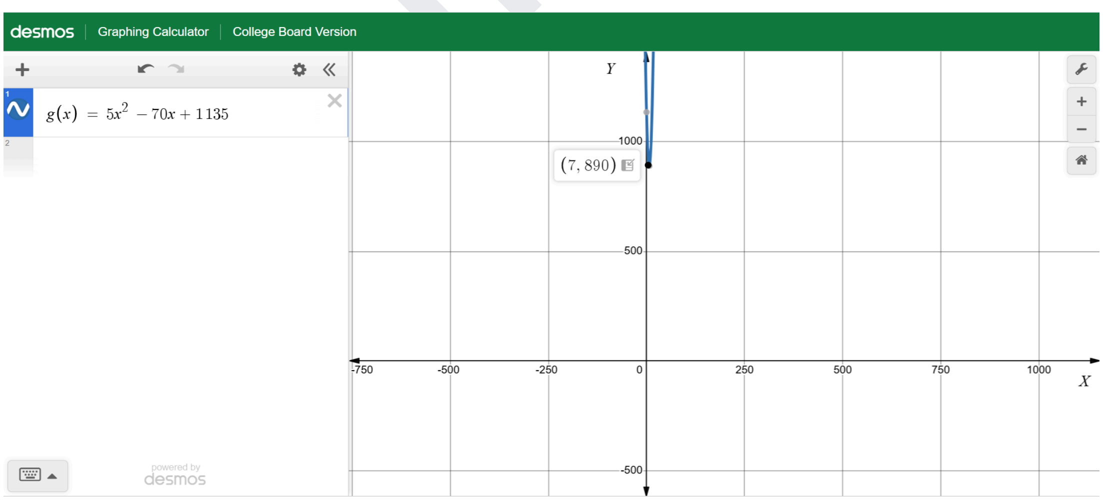
**Rationale**

**Use Desmos instead of manual algebra**

1. Open the SAT Graphing Calculator (Desmos):
   https://www.desmos.com/testing/cb-sat-ap/graphing

2. Enter the function (use x in Desmos):
   $h(x) = 5x^2 - 70x + 1135$
   *(We use* x *instead of* n*, because Desmos uses* x *by default.)*

3. Find the lowest point of the parabola (the vertex).
   Desmos will display the curve; the minimum occurs at its bottom.



From the graph you'll read:
Vertex at (7, 890).

So the least value of the function is 890, reached when $n = 7$.
**Final Answer: 890**

**Alternate algebraic method :**

Rewrite $h(n)$ in the form $a(n - h)^2 + k$, where $a > 0$ so the minimum is $k$ at $n = h$.

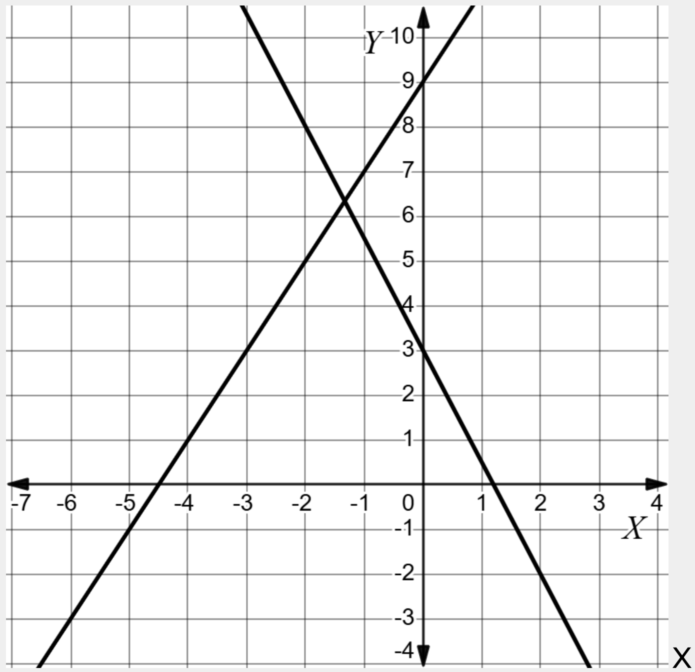
Step 1: Factor the quadratic part.
$h(n) = 5n^2 - 70n + 1{,}135$
$= 5(n^2 - 14n) + 1{,}135$

Step 2: Complete the square inside the parentheses.
Half of $-14$ is $-7$; $(-7)^2 = 49$.
$= 5[(n^2 - 14n + 49) - 49] + 1{,}135$
$= 5[(n - 7)^2 - 49] + 1{,}135$

Step 3: Distribute and simplify to vertex form.
$= 5(n - 7)^2 - 245 + 1{,}135$
$= 5(n - 7)^2 + 890$

This is $h(n) = a(n - h)^2 + k$ with $a = 5$, $h = 7$, $k = 890$.
Since $a > 0$, the minimum value is 890, attained at $n = 7$.

| Q-3 | #Hard | #Algebra | #Systems of two linear ... |
|---|---|---|---|




Which system best models the two lines in the figure?

| | |
|---|---|
| Option A | $2x + y = 9$<br>$5x - 2y = 6$ |
| Option B | $-2x + y = -9$<br>$5x + 2y = 6$ |
| Option C | $-2x + y = 9$<br>$5x - 2y = 6$ |
| Option D | $-2x + y = 9$<br>$5x + 2y = 6$ |
| Correct Answer | Option D |

**Solution:**

Desmos based

For SAT questions that require you to match a graph to a system of equations, a much faster strategy than solving by hand is to use the official Desmos calculator.

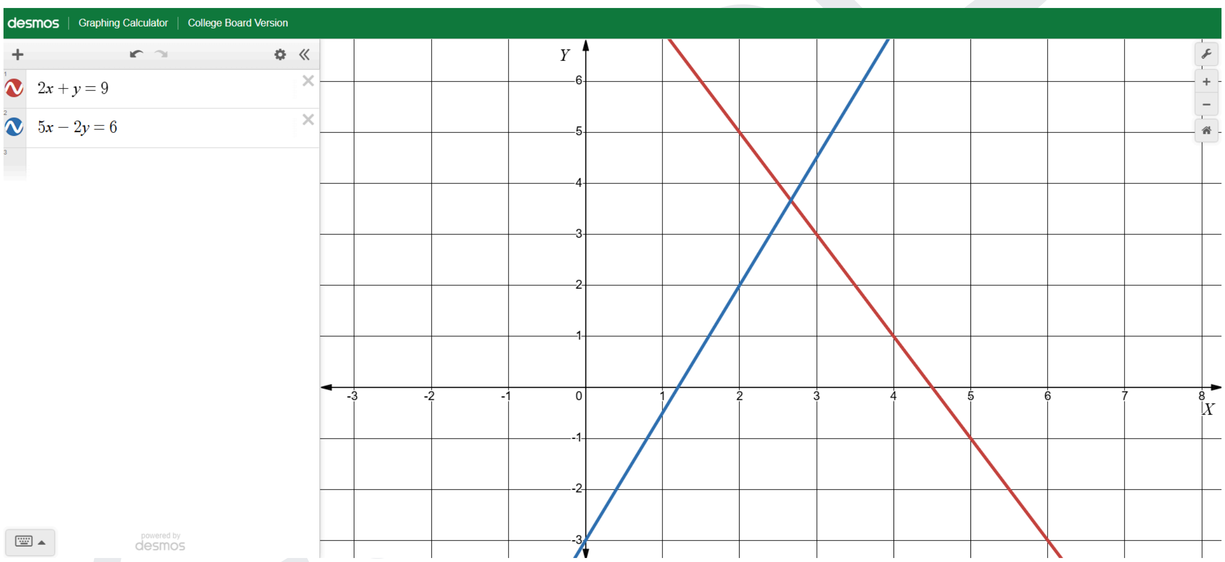
You can access the exact version of the calculator used on the test at **desmos.com/testing/cb-sat-ap**. Simply input the pair of equations from each answer choice into Desmos to visually compare the results with the graph in the question and find the correct match.

Let's see what happens:

Choice A:

2x + y = 9

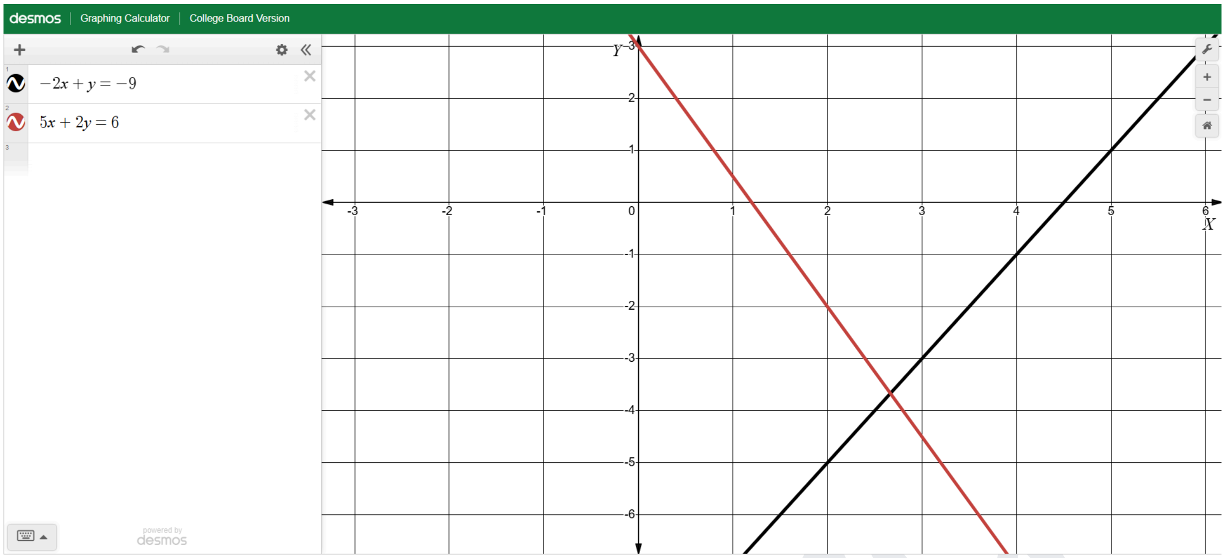
5x − 2y = 6




→ These don't match the graph. The lines don't intersect correctly.

Choice B:

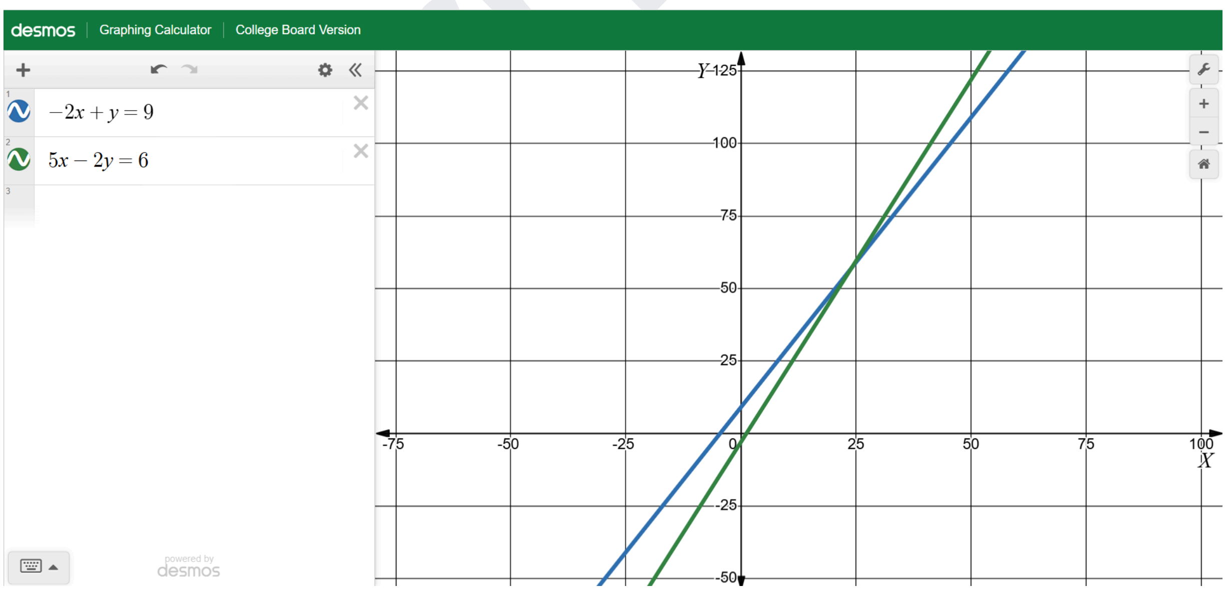
−2x + y = −9
5x + 2y = 6




→ These lines are way off. Their orientation doesn't match what's in the question.

Choice C:

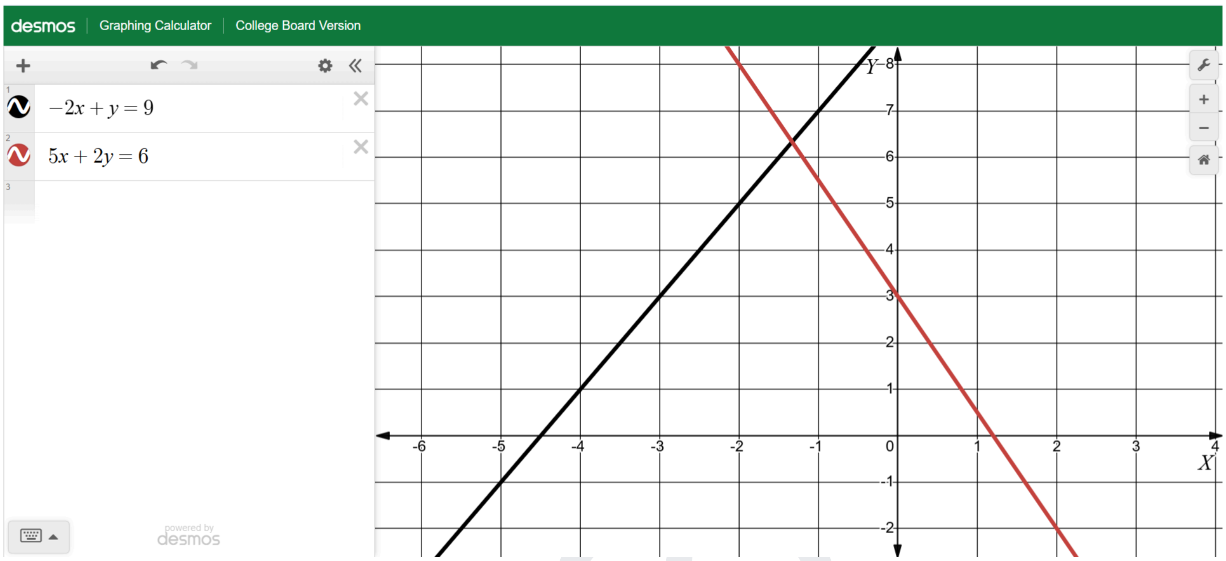
−2x + y = 9
5x − 2y = 6




→ These don't match either. These lines are way off.

Choice D:

$-2x + y = 9$
$5x + 2y = 6$




→ These match the given graph perfectly. Both the intersection point and the slopes line up.

**Hence, Choice D is correct**

**Alternative Algebraic Solution:**

Choice D is correct.
Algebra from the given graph :

1. Upward line: pick two clean points on it, say (−3, 3) and (0, 9).
   Slope $m = \frac{(9-3)}{(0-(-3))} = \frac{6}{3} = 2$.
2. Using y = mx + b and the y-intercept at x = 0 → b = 9, so y = 2x + 9.
   Standard form: −2x + y = 9.

3. Downward line: use (0, 3) and (2, −2).
   Slope $m = \frac{(-2-3)}{(2-0)} = \frac{-5}{2}$.
   With x = 0 giving y = 3, we get $y = -\frac{5}{2}x + 3$.
   Multiply by 2: 2y = −5x + 6 → 5x + 2y = 6.

So the graph corresponds to the system:
−2x + y = 9
5x + 2y = 6

Eliminate the wrong choices by converting each to slope–intercept form:

- A) 2x + y = 9 → y = −2x + 9 (negative slope) and $5x - 2y = 6 \rightarrow y = \frac{5}{2}x - 3$ (positive slope). The graph needs one positive-slope line through y = 9 and one negative-slope line through y = 3. A has the slope signs reversed.
- B) −2x + y = −9 → y = 2x − 9 (right slope, wrong intercept);

  $5x + 2y = 6 \rightarrow y = -\frac{5}{2}x + 3$ (matches second line). Both must match, so B is out.
- C) −2x + y = 9 (matches the rising line), but $5x - 2y = 6 \rightarrow y = \frac{5}{2}x - 3$ (positive slope), which contradicts the graph's falling line.
- D) −2x + y = 9 → y = 2x + 9 (rises, y-intercept 9) and $5x + 2y = 6 \rightarrow y = -\frac{5}{2}x + 3$ (falls, y-intercept 3). This matches both lines.

| Q-4 | #Hard | #Geometry a... | #Right triangles and trig... |
|---|---|---|---|

A rectangular LED scoreboard is mounted so that all four corners just touch a circular truss. The diagonal of the rectangle is $\frac{5}{3}$ times the length of its shorter side, and the area of the rectangle is 1,728 square units. What is the diameter of the circular truss, in units?

| | |
|---|---|
| Correct Answer | 60 |

**Solution:**

**Correct Answer:** 60

**Rationale**

The scoreboard's four corners lie on the circular truss. That means the rectangle is inscribed in the circle. In this setup, any diagonal of the rectangle passes through the circle's center and stretches from one point on the circle to the opposite point, so the rectangle's diagonal is exactly the circle's diameter.

Think of a diagonal and the two sides it connects: they form a right triangle, with the two sides of the rectangle as the legs and the diagonal as the hypotenuse.

Let s be the length of the shorter side of the rectangle. We're told the diagonal is $\frac{5}{3}$ times the shorter side, so the diagonal has length $\frac{5}{3}s$.

Use the Pythagorean relationship for a rectangle with shorter side s, longer side L, and diagonal $\frac{5}{3}s$:

$$s^2 + L^2 = \left(\frac{5}{3}s\right)^2$$

$$s^2 + L^2 = \frac{25}{9}s^2$$

$$L^2 = \left(\frac{25}{9} - 1\right)s^2 = \frac{16}{9}s^2$$

So $L = \frac{4}{3}s$ (take the positive root since lengths are positive).

Now bring in the area. The area of the rectangle is s × L, and we're given that this area is 1,728 square units:

$$s \times L = 1,728$$
$$s \times \frac{4}{3}s = 1,728$$
$$\frac{4}{3}s^2 = 1,728$$

Solve for $s^2$:

$$s^2 = \frac{3}{4} \times 1,728 = 1,296$$

So s = 36 (the positive root).

With s known, find the diagonal:

$$diagonal = \frac{5}{3}s = \frac{5}{3} \times 36 = 60$$

As established at the start, the circle's diameter equals the rectangle's diagonal. Therefore, the diameter of the circular truss is 60 units.

| Q-5 | #Hard | #Problem-Solvi... | #Probability and condition... |
|---|---|---|---|

A multiplex has two types of screens: IMAX and Standard. There are 5 IMAX screens and 8 Standard screens. Each IMAX screen has 36 premium (recliner) seats and 84 regular seats. Each Standard screen has 24 premium seats and 96 regular seats.

A screen is chosen at random, then a seat from that screen is chosen at random. What is the probability that the chosen seat is from a Standard screen, given that it is a premium seat?

| | |
|---|---|
| Option A | $\frac{1}{65}$ |
| Option B | $\frac{1}{10}$ |
| Option C | $\frac{1}{5}$ |
| Option D | $\frac{16}{31}$ |
| Correct Answer | Option D |

**Solution:**

**Correct Answer:** D

**Rationale**

We need P(Standard | premium) = (number of premium seats in Standard screens) / (total number of premium seats), because every screen has the same total number of seats (120), so "row-then-seat" is equivalent to choosing uniformly from all seats.

Premium seats:

- IMAX: 5 screens × 36 premium = 180

- Standard: 8 screens × 24 premium = 192

Total premium = 180 + 192 = 372

Therefore, P(Standard | premium) = $\frac{192}{372} = \frac{16}{31}$.

Why the others are wrong:
Choice A is incorrect. This may come from dividing the number of premium seats in one Standard screen (24) by the total number of all seats in the multiplex, not just the premium seats:
(5 × 36) + (5 × 84) + (8 × 24) + (8 × 96) = 180 + 420 + 192 + 768 = 1,560,
so $\frac{24}{1{,}560} = \frac{1}{65}$

Choice B is incorrect. This results from incorrectly adding one-screen seat counts without accounting for the number of screens. It adds only the per-screen values (36 + 84 + 24 + 96 = 240) and then divides 24 by that total: $\frac{24}{240} = \frac{1}{10}$.

Choice C is incorrect. This may come from dividing the number of premium seats per Standard screen by the total seats in a Standard screen: $\frac{24}{(24+96)} = \frac{24}{120} = \frac{1}{5}$. The denominator should be all premium seats (IMAX + Standard), not total seats in a Standard screen.

CURRIFORGE

FREE, NO STRINGS

# Send 10 questions.

## Get a severity-tiered QC report in 72 hours.

Pick any 10 items from your existing bank. We re-solve them independently and return verified keys, issues flagged by severity, and corrections your team can paste straight in. If your content is clean, you get that in writing. If it is not, you find out from us instead of from a parent.


| | |
|---|---|
| EMAIL | hello@curriforge.co |
| WEB | curriforge.co |
| WHATSAPP | +91 96373 03672 |
| BOOK A CALL | cal.com/amit-manwani-qe0kwc |