

# 1. Linear equations and functions

SAT Clarity teaching kit

Original supplementary instruction

## Teaching notes

Introduce the skill. These materials are independent of College Board.

## 2. Learning goal

Solve linear equations, interpret slope and intercept, and check the requested quantity.  
Before starting: Arithmetic, negative numbers and the distributive property

### Teaching notes

Ask learners to restate the goal. Check the prerequisite before proceeding.

### 3. Diagnostic

If  $3x + 6 = 21$ , what is  $x$ ?

- A. 3
- B. 5
- C. 7
- D. 9

#### Teaching notes

Allow quiet thinking before sharing. Record reasoning rather than just the letter.

## 4. Diagnostic reasoning

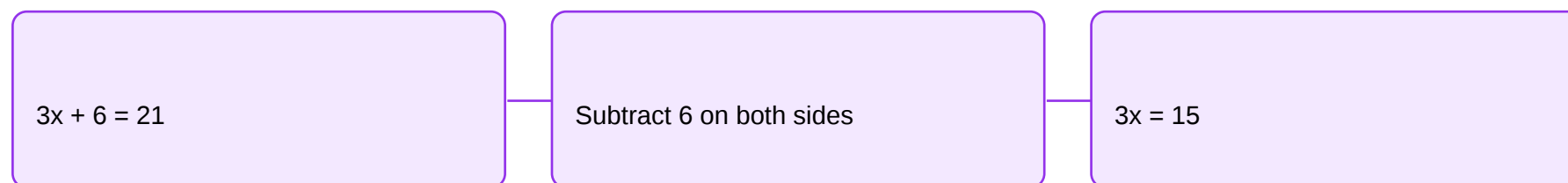
Subtract 6:  $3x = 15$ . Divide by 3:  $x = 5$ .

### Teaching notes

Answer: B. A: 3 gives 15, not 21. B: Subtract 6:  $3x = 15$ . Divide by 3:  $x = 5$ . C: 7 results from dividing 21 before removing the 6. D: 9 gives 33, not 21.

## 5. Equivalent equations

Applying the same valid operation to both sides preserves the solution. For  $3x + 6 = 21$ , subtract 6 from both sides before dividing by 3.

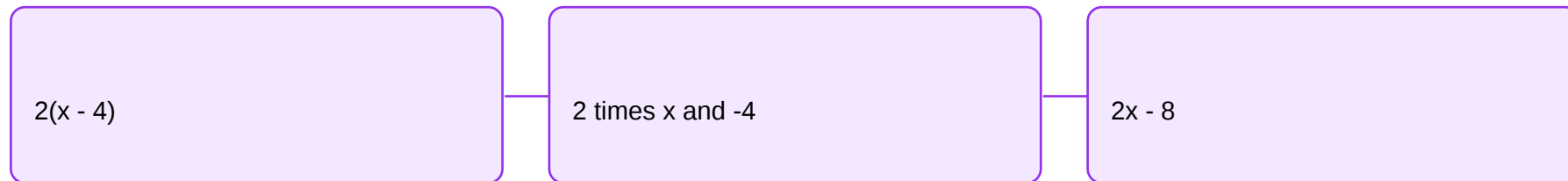


### Teaching notes

Ask for an explanation in the learner's own words. Connect this concept to the next worked example.

## 6. Distribution and signs

$2(x - 4) = 2x - 8$ . Multiply each term inside the parentheses. A negative factor changes both signs.

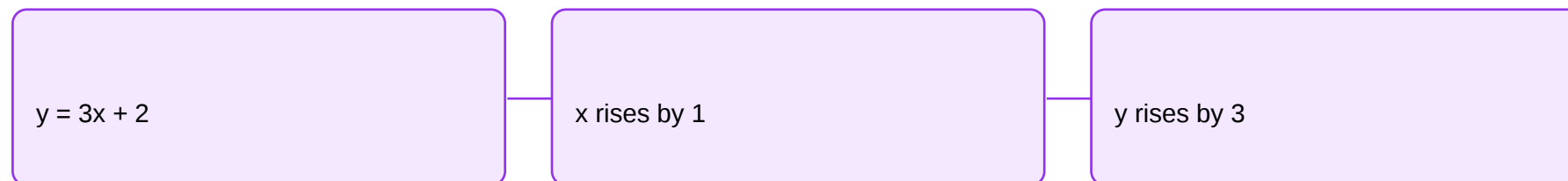


### Teaching notes

Ask for an explanation in the learner's own words. Connect this concept to the next worked example.

## 7. Slope and intercept

In  $y = mx + b$ ,  $m$  is the change in  $y$  per unit increase in  $x$ .  $b$  is the value of  $y$  when  $x = 0$ .

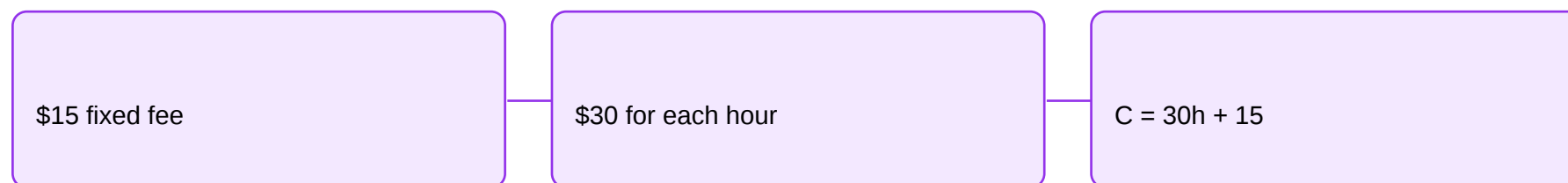


### Teaching notes

Ask for an explanation in the learner's own words. Connect this concept to the next worked example.

## 8. Applications and units

A fixed charge contributes to the intercept. A charge per unit contributes to the slope. State what each variable measures.

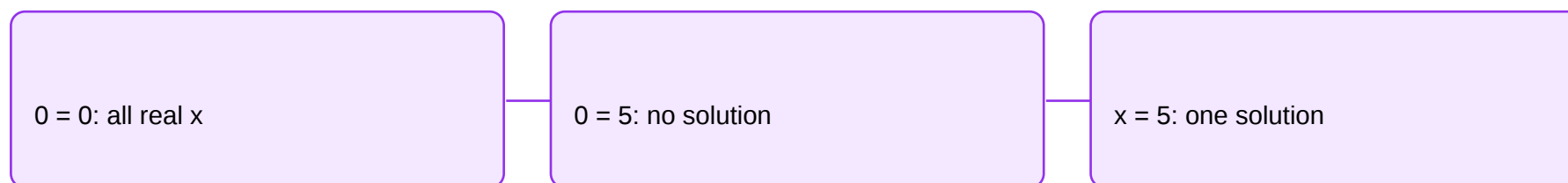


### Teaching notes

Ask for an explanation in the learner's own words. Connect this concept to the next worked example.

## 9. Solution count

After simplifying,  $0 = 0$  means all real values satisfy the equation. A contradiction such as  $0 = 5$  means no solution.



### Teaching notes

Ask for an explanation in the learner's own words. Connect this concept to the next worked example.

## 10. Worked example 1

If  $2(x - 4) = 10$ , what is  $x$ ?

- A. 1
- B. 5
- C. 9
- D. 14

### Teaching notes

Model reading the prompt and identifying the requested quantity or relationship before solving.

## 11. Example 1 reasoning

Divide by 2:  $x - 4 = 5$ . Add 4:  $x = 9$ .

### Teaching notes

Answer: C. A: 1 gives -6, not 10. B: 5 gives 2, not 10. C: Divide by 2:  $x - 4 = 5$ . Add 4:  $x = 9$ . D: 14 adds 4 to 10 without first dividing by 2.

## 12. Worked example 2

A tutor charges a \$15 booking fee and \$30 per hour. Which equation gives cost  $C$  for  $h$  hours?

A.  $C = 15h + 30$

B.  $C = 30h + 15$

C.  $C = 45h$

D.  $C = 30h - 15$

### Teaching notes

Model reading the prompt and identifying the requested quantity or relationship before solving.

## 13. Example 2 reasoning

30h is the hourly charge. Add the one-time \$15 fee.

### Teaching notes

Answer: B. A: This reverses the fixed fee and hourly rate. B: 30h is the hourly charge. Add the one-time \$15 fee. C: This incorrectly charges the booking fee every hour. D: This subtracts a fee that the customer must pay.

## 14. Worked example 3

A line passes through (1, 2) and (4, 11). What is its slope?

- A.  $\frac{1}{3}$
- B. 3
- C. 9
- D.  $\frac{13}{5}$

### Teaching notes

Model reading the prompt and identifying the requested quantity or relationship before solving.

## 15. Example 3 reasoning

$$\text{Slope} = (11 - 2)/(4 - 1) = 9/3 = 3.$$

### Teaching notes

Answer: B. A:  $1/3$  reverses change in y divided by change in x. B:  $\text{Slope} = (11 - 2)/(4 - 1) = 9/3 = 3$ . C: 9 is the change in y, without dividing by change in x. D:  $13/5$  uses sums rather than differences.

## 16. Incomplete distribution

$3(x - 2)$  equals  $3x - 6$ . Multiplying  $x$  alone changes the equation.

### Teaching notes

Ask students to explain how the error changes the result. Use a counterexample if needed.

## 17. Requested expression

If the prompt asks for  $2x$ , finish by doubling the solved value of  $x$ .

### Teaching notes

Ask students to explain how the error changes the result. Use a counterexample if needed.

## 18. Slope versus intercept

A starting fee and a rate describe different quantities. Use units to distinguish them.

### Teaching notes

Ask students to explain how the error changes the result. Use a counterexample if needed.

## 19. Answer verification

Substitute into the original equation. Equal values on both sides provide a direct check.

### Teaching notes

Ask students to explain how the error changes the result. Use a counterexample if needed.

## 20. Guided practice 1

If  $5x - 2 = 3x + 8$ , what is  $2x$ ?

- A. 5
- B. 6
- C. 10
- D. 20

### Teaching notes

Learners solve first. Ask partners to justify a choice and reject an alternative.

## 21. Guided practice 1 reasoning

Subtract  $3x$  and add 2:  $2x = 10$ .

### Teaching notes

Answer: C. A: 5 is  $x$ , while the prompt asks for  $2x$ . B: 6 does not satisfy the equation for  $2x$ . C: Subtract  $3x$  and add 2:  $2x = 10$ . D: 20 doubles the already requested value  $2x = 10$ .

## 22. Guided practice 2

Which equation describes a line parallel to  $y = 4x$  that passes through  $(2, 5)$ ?

- A.  $y = 4x - 3$
- B.  $y = 4x + 3$
- C.  $y = 2x + 5$
- D.  $y = x/4 + 5$

### Teaching notes

Learners solve first. Ask partners to justify a choice and reject an alternative.

## 23. Guided practice 2 reasoning

Parallel lines have slope 4.  $5 = 8 + b$  gives  $b = -3$ .

### Teaching notes

Answer: A. A: Parallel lines have slope 4.  $5 = 8 + b$  gives  $b = -3$ . B: At  $x = 2$  this gives 11, not 5. C: Slope 2 is not parallel to slope 4. D: Slope  $1/4$  is not parallel to slope 4.

## 24. Guided practice 3

How many real solutions does  $2(x + 3) = 2x + 6$  have?

- A. None
- B. One
- C. Two
- D. Infinitely many

### Teaching notes

Learners solve first. Ask partners to justify a choice and reject an alternative.

## 25. Guided practice 3 reasoning

Both sides simplify to  $2x + 6$ , so every real  $x$  works.

### Teaching notes

Answer: D. A: Distribution produces an identity, not a contradiction. B: No single  $x$  is distinguished by the identity. C: Every real  $x$  works, not just two values. D: Both sides simplify to  $2x + 6$ , so every real  $x$  works.

## 26. Independent practice 1

If  $(x + 3)/4 = 5$ , what is  $x$ ?

- A. 2
- B. 8
- C. 17
- D. 23

### Teaching notes

Answer: C. A: Subtracting before removing the division changes the equation. B: 8 gives  $11/4$ , not 5. C: Multiply by 4:  $x + 3 = 20$ . Subtract 3:  $x = 17$ . D: 23 adds 3 when it should be subtracted.

## 27. Independent practice 2

A tank contains 50 liters and drains at 2 liters per minute. Which expression gives its volume after  $t$  minutes, before it empties?

A.  $50 + 2t$

B.  $2t - 50$

C.  $50 - 2t$

D.  $25 - t$

### Teaching notes

Answer: C. A: This models filling rather than draining. B: This starts at a negative volume. C: Starting volume minus drained volume is  $50 - 2t$ . D: This gives time remaining, not volume in liters.

## 28. Independent practice 3

How many real solutions does  $3x + 1 = 3x + 4$  have?

- A. None
- B. One
- C. Three
- D. Infinitely many

### Teaching notes

Answer: A. A: Subtracting  $3x$  gives  $1 = 4$ , a contradiction. B: No  $x$  can make 1 equal 4. C: The coefficient 3 does not determine solution count. D: An identity would have equal constants, which these do not.

## 29. Exit ticket

The line  $y = -2x + 7$  has what y-intercept?

- A. -2
- B. 2
- C. 5
- D. 7

### Teaching notes

Answer: D. A: -2 is the slope. B: 2 is the slope magnitude, not the intercept. C: 5 is y when  $x = 1$ , not  $x = 0$ . D: At  $x = 0$ ,  $y = 7$ , so the y-intercept is 7. Ask the learner to name one remaining uncertainty.

## 30. Review and next practice

Independent answers: 1: C, 2: C, 3: A

Return to the concept behind each missed item.

Use the extension question in the worksheet.

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### Teaching notes

Review the separate teacher edition for all distractor explanations. Domain mapping source: <https://satsuite.collegeboard.org/higher-ed-professionals/sat-validity/content-domains> . Difficulty estimates are instructional, not empirically calibrated.