Grade 8 Slope and Linear Equations Workbook

5 lessons · printable · answer key at the back

Name _____ Date _____

Contents

Slope

WORKED EXAMPLE

$y = 5x + 37$ $m = 5$

1. Finding the slope

Write the slope of each line.

1 $y = 10x + 28$ $m =$ ____

2 $y = 12x + 1$ $m =$ ____

3 $y = 8x + 22$ $m =$ ____

4 $y = -4x - 25$ $m =$ ____

5 $y = -6x - 17$ $m =$ ____

6 $y = 8x - 28$ $m =$ ____

7 $y = x + 5$ $m =$ ____

8 $y = -10x - 20$ $m =$ ____

9 $y = -2x - 2$ $m =$ ____

10 $y = x + 26$ $m =$ ____

11 $y = 10x + 38$ $m =$ ____

12 $y = -12x - 24$ $m =$ ____

13 $y = -4x - 23$ $m =$ ____

14 $y = -6x - 24$ $m =$ ____

15 $y = 6x - 7$ $m =$ ____

16 $y = -21$ $m =$ ____

17 $y = x - 22$ $m =$ ____

18 $y = 6x + 37$ $m =$ ____

19 $y = -11x - 19$ $m =$ ____

20 $y = -6x - 29$ $m =$ ____

21 $y = 11x + 25$ $m =$ ____

22 $y = x + 10$ $m =$ ____

23 $y = 4x - 22$ $m =$ ____

24 $y = 11x + 24$ $m =$ ____

2. Finding the y-intercept

Write the y-intercept of each line.

25 $y = -11x - 17$ $b =$ ____

26 $y = -6x - 24$ $b =$ ____

27 $y = -2x - 26$ $b =$ ____

28 $y = -10x - 27$ $b =$ ____

29 $y = -6x - 22$ $b =$ ____

30 $y = 5x - 26$ $b =$ ____

31 $y = 3x - 25$ $b =$ ____

32 $y = 9x - 9$ $b =$ ____

33 $y = 6x + 40$ $b =$ ____

34 $y = 3x - 23$ $b =$ ____

35 $y = -9x - 21$ $b =$ ____

36 $y = 5x + 3$ $b =$ ____

37 $y = -x - 4$ $b =$ ____

38 $y = -7x + 38$ $b =$ ____

39 $y = -11x + 17$ $b =$ ____

40 $y = -5x - 18$ $b =$ ____

41 $y = 11x + 19$ $b =$ ____

42 $y = 11x + 33$ $b =$ ____

43 $y = -6x + 36$ $b =$ ____

44 $y = -7x - 12$ $b =$ ____

45 $y = 6x + 2$ $b =$ ____

46 $y = 12x - 14$ $b =$ ____

47 $y = 3x - 15$ $b =$ ____

48 $y = -4x + 33$ $b =$ ____

3. Solving equations

Solve each equation for x.

49 $4x + 37 = 10x + 13$ ____

50 $8x + 10 = 6x + 12$ ____

51 $12x + 2 = 6x + 32$ ____

52 $7x + 16 = 9x + 12$ ____

53 $5x + 12 = 3x + 18$ ____

54 $4x + 40 = 9x + 15$ ____

55 $4x + 7 = 6x + 5$ ____

56 $5x + 8 = x + 16$ ____

57 $11x + 13 = 9x + 31$ ____

58 $3x + 20 = 8x + 5$ ____

Rate of Change

WORKED EXAMPLE

x	5	6	7	8
y	29	24	19	14

rate → -5

y step = −5, x step = 1
−5 ÷ 1 = −5
rate of change = −5

4. Rate of change from a table

Each table is a straight line. Find what each one asks for.

1

x	1	2	3	4
y	42	33	24	15

rate → ___

2

x	1	4	7	10
y	33	48	63	78

rate → ___

3

x	3	4	5	6
y	35	32	29	26

rate → ___

4

x	2	3	4	5
y	51	57	63	69

rate → ___

5

x	7	11	15	19
y	39	47	55	63

rate → ___

6

x	6	7	8	9
y	55	47	39	31

rate → ___

7

x	3	4	5	6
y	18	12	6	0

rate → ___

8

x	9	13	17	21
y	37	41	45	49

rate → ___

4. Rate of change from a table (continued)

Each table is a straight line. Find what each one asks for.

9

x	4	5	6	7
y	59	65	71	77

rate → ___

10

x	9	10	11	12
y	58	52	46	40

rate → ___

11

x	6	10	14	18
y	59	83	107	131

rate → ___

12

x	6	7	8	9
y	61	65	69	73

rate → ___

13

x	4	8	12	16
y	49	89	129	169

rate → ___

14

x	6	7	8	9
y	20	17	14	11

rate → ___

15

x	2	3	4	5
y	42	44	46	48

rate → ___

16

x	2	8	14	20
y	21	81	141	201

rate → ___

17

x	1	2	3	4
y	48	56	64	72

rate → ___

18

x	2	7	12	17
y	154	109	64	19

rate → ___

19

x	3	4	5	6
y	46	49	52	55

rate → ___

20

x	6	7	8	9
y	86	94	102	110

rate → ___

4. Rate of change from a table (continued)

Each table is a straight line. Find what each one asks for.

21

x	3	5	7	9
y	50	34	18	2

rate → ___

22

x	8	9	10	11
y	26	23	20	17

rate → ___

23

x	2	7	12	17
y	38	48	58	68

rate → ___

24

x	5	6	7	8
y	47	42	37	32

rate → ___

5. Systems of equations

Solve each pair by adding the two equations.

25 $11x + 9y = -4$
$-8x - 9y = -29$

26 $3x + 6y = -18$
$4x - 6y = 18$

27 $-10x + 2y = 0$
$4x - 2y = -6$

28 $7x + 11y = 42$
$6x - 11y = 36$

29 $-8x + 6y = -52$
$5x - 6y = 46$

30 $-10x + 6y = -54$
$-5x - 6y = 54$

31 $8x + 4y = 32$
$-3x - 4y = 8$

32 $-2x + 6y = 60$
$10x - 6y = 36$

33 $10x + 8y = 56$
$5x - 8y = 4$

34 $6x + 9y = 36$
$4x - 9y = -36$

Comparing Rates

WORKED EXAMPLE

A 72 dollars in 6 weeks
B y = 14x, y dollars and x weeks

A / (B)

6. Which rate is greater?

Which one is greater, A or B? Work out each rate first. Circle one.

1 A y = 10x, y meters and x seconds
B 39 meters in 3 seconds
A / B

2 A 84 km in 7 hours
B y = 6x, y km and x hours
A / B

3 A 12 km in 2 hours
B y = 13x, y km and x hours
A / B

4 A y = 11x, y km and x hours
B 28 km in 7 hours
A / B

5 A y = 12x, y meters and x seconds
B 49 meters in 7 seconds
A / B

6 A 35 km in 7 hours
B y = 10x, y km and x hours
A / B

7 A 84 km in 7 hours
B y = 10x, y km and x hours
A / B

8 A 40 dollars in 5 weeks
B y = 5x, y dollars and x weeks
A / B

9 A y = 2x, y meters and x seconds
B 12 meters in 4 seconds
A / B

10 A y = 9x, y km and x hours
B 64 km in 8 hours
A / B

11 A y = 13x, y meters and x seconds
B 49 meters in 7 seconds
A / B

12 A y = 13x, y words and x minutes
B 66 words in 6 minutes
A / B

13 A y = 4x, y km and x hours
B 30 km in 3 hours
A / B

14 A y = 13x, y pages and x days
B 18 pages in 2 days
A / B

7. How many solutions?

How many solutions does each equation have? Show how you know.

15 $-19x - 32 = -32 - 19x$

16 $17x - 21 = 17x - 29$

17 $11x - 39 = -39 + 11x$

18 $12x + 49 = x + 18$

19 $-8x - 5 = -8x$

20 $2x - 24 = -7x + 1$

21 $-20x + 25 = -20x + 20$

22 $2x - 6 = 2x - 4$

23 $18x - 54 = -54 + 18x$

24 $x - 33 = 15x - 39$

Is It Linear?

WORKED EXAMPLE

$y = 13x + 17$ **Linear** / Nonlinear

8. Linear or nonlinear

Is each equation linear or nonlinear? Circle one.

1. $y = 11x + 24$ Linear / Nonlinear
2. $y = x^2 + 16$ Linear / Nonlinear
3. $y = 61/x$ Linear / Nonlinear
4. $y = 16x + 22$ Linear / Nonlinear
5. $y = 2x^2 + 37$ Linear / Nonlinear
6. $y = 92$ Linear / Nonlinear
7. $y = 12x + 26$ Linear / Nonlinear
8. $y = 2x^2 + 20$ Linear / Nonlinear
9. $y = 49/x$ Linear / Nonlinear
10. $y = 7x - 9$ Linear / Nonlinear
11. $y = 11x^3 + 32$ Linear / Nonlinear
12. $y = 20/x$ Linear / Nonlinear
13. $y = 20$ Linear / Nonlinear
14. $y = 9x + 15$ Linear / Nonlinear
15. $y = 6x^3 + 22$ Linear / Nonlinear
16. $y = 86$ Linear / Nonlinear
17. $y = 5x^2 + 18$ Linear / Nonlinear
18. $y = 95/x$ Linear / Nonlinear
19. $y = 13x - 42$ Linear / Nonlinear
20. $y = 35$ Linear / Nonlinear
21. $y = x^3 + 31$ Linear / Nonlinear
22. $y = 24x - 16$ Linear / Nonlinear
23. $y = 35/x$ Linear / Nonlinear
24. $y = 3x^2 + 12$ Linear / Nonlinear

9. Finding the slope

Write the slope of each line.

25. $y = 10x + 30$ $m =$ ___
26. $y = -6x + 33$ $m =$ ___
27. $y = 8x + 22$ $m =$ ___
28. $y = -4x - 25$ $m =$ ___
29. $y = -14$ $m =$ ___
30. $y = 12x + 36$ $m =$ ___
31. $y = -8x + 35$ $m =$ ____
32. $y = x - 27$ $m =$ ____
33. $y = 9x + 9$ $m =$ ____
34. $y = -2x - 26$ $m =$ ____
35. $y = 9x + 19$ $m =$ ____
36. $y = x + 26$ $m =$ ____
37. $y = -x + 20$ $m =$ ____
38. $y = -x + 22$ $m =$ ____
39. $y = -12x - 24$ $m =$ ____
40. $y = -12x - 30$ $m =$ ____
41. $y = 9x + 23$ $m =$ ____
42. $y = x + 25$ $m =$ ____
43. $y = -12x + 10$ $m =$ ____
44. $y = -11x - 27$ $m =$ ____

Is It a Function?

WORKED EXAMPLE

x	4	6	15	6
y	58	38	32	49

6 → 38 and 6 → 49
Not a function

10. Is it a function?

Does each table show a function? Show how you know.

1

x	5	22	2	12
y	17	17	44	35

2

x	0	11	0	18
y	20	32	60	16

3

x	14	19	0	7
y	47	23	34	34

4

x	9	0	9	10
y	58	29	45	35

5

x	1	24	6	11
y	59	52	54	59

6

x	11	16	10	7
y	52	47	10	52

7

x	1	6	6	20
y	55	29	17	18

8

x	11	18	10	17
y	32	5	32	41

9

x	8	16	24	8
y	22	49	24	17

10

x	0	9	10	2
y	47	46	16	46

11

x	9	15	21	13
y	11	45	45	52

12

x	1	18	12	18
y	7	32	45	52

13

x	17	20	9	19
y	1	3	1	44

14

x	6	6	16	20
y	43	40	56	25

11. Finding the slope

Write the slope of each line.

15 $y = 12x + 1$ m = ___

16 $y = 10x + 36$ m = ___

17 $y = 11x - 16$ m = ___

18 $y = 6x - 26$ m = ___

19 $y = -4x - 20$ m = ___

20 $y = 5x - 16$ m = ___

21 $y = 12x + 36$ m = ___

22 $y = -8x + 35$ m = ___

23 $y = x - 27$ m = ___

24 $y = -6x - 19$ m = ___

Answer Key (1 of 4)

Slope

Finding the slope

1. y = 10x + 28 → m = 10
2. y = 12x + 1 → m = 12
3. y = 8x + 22 → m = 8
4. y = −4x − 25 → m = −4
5. y = −6x − 17 → m = −6
6. y = 8x − 28 → m = 8
7. y = x + 5 → m = 1
8. y = −10x − 20 → m = −10
9. y = −2x − 2 → m = −2
10. y = x + 26 → m = 1
11. y = 10x + 38 → m = 10
12. y = −12x − 24 → m = −12
13. y = −4x − 23 → m = −4
14. y = −6x − 24 → m = −6
15. y = 6x − 7 → m = 6
16. y = −21 → m = 0
17. y = x − 22 → m = 1
18. y = 6x + 37 → m = 6
19. y = −11x − 19 → m = −11
20. y = −6x − 29 → m = −6
21. y = 11x + 25 → m = 11
22. y = x + 10 → m = 1
23. y = 4x − 22 → m = 4
24. y = 11x + 24 → m = 11

Finding the y-intercept

25. y = −11x − 17 → b = −17
26. y = −6x − 24 → b = −24
27. y = −2x − 26 → b = −26
28. y = −10x − 27 → b = −27
29. y = −6x − 22 → b = −22
30. y = 5x − 26 → b = −26
31. y = 3x − 25 → b = −25
32. y = 9x − 9 → b = −9
33. y = 6x + 40 → b = 40
34. y = 3x − 23 → b = −23
35. y = −9x − 21 → b = −21
36. y = 5x + 3 → b = 3
37. y = −x − 4 → b = −4
38. y = −7x + 38 → b = 38
39. y = −11x + 17 → b = 17
40. y = −5x − 18 → b = −18
41. y = 11x + 19 → b = 19
42. y = 11x + 33 → b = 33
43. y = −6x + 36 → b = 36
44. y = −7x − 12 → b = −12
45. y = 6x + 2 → b = 2

Slope (continued)

Finding the y-intercept (continued)

46. y = 12x − 14 → b = −14
47. y = 3x − 15 → b = −15
48. y = −4x + 33 → b = 33

Solving equations

49. 4x + 37 = 10x + 13 → x = 4
50. 8x + 10 = 6x + 12 → x = 1
51. 12x + 2 = 6x + 32 → x = 5
52. 7x + 16 = 9x + 12 → x = 2
53. 5x + 12 = 3x + 18 → x = 3
54. 4x + 40 = 9x + 15 → x = 5
55. 4x + 7 = 6x + 5 → x = 1
56. 5x + 8 = x + 16 → x = 2
57. 11x + 13 = 9x + 31 → x = 9
58. 3x + 20 = 8x + 5 → x = 3

Rate of Change

Rate of change from a table

1. x: 1, 2, 3, 4 y: 42, 33, 24, 15 → −9 (y moves −9 while x moves 1, and −9 ÷ 1 = −9)
2. x: 1, 4, 7, 10 y: 33, 48, 63, 78 → 5 (y moves 15 while x moves 3, and 15 ÷ 3 = 5)
3. x: 3, 4, 5, 6 y: 35, 32, 29, 26 → −3 (y moves −3 while x moves 1, and −3 ÷ 1 = −3)
4. x: 2, 3, 4, 5 y: 51, 57, 63, 69 → 6 (y moves 6 while x moves 1, and 6 ÷ 1 = 6)
5. x: 7, 11, 15, 19 y: 39, 47, 55, 63 → 2 (y moves 8 while x moves 4, and 8 ÷ 4 = 2)
6. x: 6, 7, 8, 9 y: 55, 47, 39, 31 → −8 (y moves −8 while x moves 1, and −8 ÷ 1 = −8)
7. x: 3, 4, 5, 6 y: 18, 12, 6, 0 → −6 (y moves −6 while x moves 1, and −6 ÷ 1 = −6)
8. x: 9, 13, 17, 21 y: 37, 41, 45, 49 → 1 (y moves 4 while x moves 4, and 4 ÷ 4 = 1)
9. x: 4, 5, 6, 7 y: 59, 65, 71, 77 → 6 (y moves 6 while x moves 1, and 6 ÷ 1 = 6)
10. x: 9, 10, 11, 12 y: 58, 52, 46, 40 → −6 (y moves −6 while x moves 1, and −6 ÷ 1 = −6)
11. x: 6, 10, 14, 18 y: 59, 83, 107, 131 → 6 (y moves 24 while x moves 4, and 24 ÷ 4 = 6)
12. x: 6, 7, 8, 9 y: 61, 65, 69, 73 → 4 (y moves 4 while x moves 1, and 4 ÷ 1 = 4)
13. x: 4, 8, 12, 16 y: 49, 89, 129, 169 → 10 (y moves 40 while x moves 4, and 40 ÷ 4 = 10)
14. x: 6, 7, 8, 9 y: 20, 17, 14, 11 → −3 (y moves −3 while x moves 1, and −3 ÷ 1 = −3)
15. x: 2, 3, 4, 5 y: 42, 44, 46, 48 → 2 (y moves 2 while x moves 1, and 2 ÷ 1 = 2)
16. x: 2, 8, 14, 20 y: 21, 81, 141, 201 → 10 (y moves 60 while x moves 6, and 60 ÷ 6 = 10)

Answer Key (2 of 4)

Rate of Change (continued)

Rate of change from a table (continued)

17. x: 1, 2, 3, 4 y: 48, 56, 64, 72 → 8 (y moves 8 while x moves 1, and 8 ÷ 1 = 8)
18. x: 2, 7, 12, 17 y: 154, 109, 64, 19 → −9 (y moves −45 while x moves 5, and −45 ÷ 5 = −9)
19. x: 3, 4, 5, 6 y: 46, 49, 52, 55 → 3 (y moves 3 while x moves 1, and 3 ÷ 1 = 3)
20. x: 6, 7, 8, 9 y: 86, 94, 102, 110 → 8 (y moves 8 while x moves 1, and 8 ÷ 1 = 8)
21. x: 3, 5, 7, 9 y: 50, 34, 18, 2 → −8 (y moves −16 while x moves 2, and −16 ÷ 2 = −8)
22. x: 8, 9, 10, 11 y: 26, 23, 20, 17 → −3 (y moves −3 while x moves 1, and −3 ÷ 1 = −3)
23. x: 2, 7, 12, 17 y: 38, 48, 58, 68 → 2 (y moves 10 while x moves 5, and 10 ÷ 5 = 2)
24. x: 5, 6, 7, 8 y: 47, 42, 37, 32 → −5 (y moves −5 while x moves 1, and −5 ÷ 1 = −5)

Systems of equations

25. 11x + 9y = −4, −8x − 9y = −29 → (−11, 13)
26. 3x + 6y = −18, 4x − 6y = 18 → (0, −3)
27. −10x + 2y = 0, 4x − 2y = −6 → (1, 5)
28. 7x + 11y = 42, 6x − 11y = 36 → (6, 0)
29. −8x + 6y = −52, 5x − 6y = 46 → (2, −6)
30. −10x + 6y = −54, −5x − 6y = 54 → (0, −9)
31. 8x + 4y = 32, −3x − 4y = 8 → (8, −8)
32. −2x + 6y = 60, 10x − 6y = 36 → (12, 14)
33. 10x + 8y = 56, 5x − 8y = 4 → (4, 2)
34. 6x + 9y = 36, 4x − 9y = −36 → (0, 4)

Comparing Rates

Which rate is greater?

1. A y = 10x, y meters and x seconds B 39 meters in 3 seconds → B (A is 10 and B is 13 per second)
2. A 84 km in 7 hours B y = 6x, y km and x hours → A (A is 12 and B is 6 per hour)
3. A 12 km in 2 hours B y = 13x, y km and x hours → B (A is 6 and B is 13 per hour)
4. A y = 11x, y km and x hours B 28 km in 7 hours → A (A is 11 and B is 4 per hour)
5. A y = 12x, y meters and x seconds B 49 meters in 7 seconds → A (A is 12 and B is 7 per second)
6. A 35 km in 7 hours B y = 10x, y km and x hours → B (A is 5 and B is 10 per hour)
7. A 84 km in 7 hours B y = 10x, y km and x hours → A (A is 12 and B is 10 per hour)
8. A 40 dollars in 5 weeks B y = 5x, y dollars and x weeks → A (A is 8 and B is 5 per week)
9. A y = 2x, y meters and x seconds B 12 meters in 4 seconds → B (A is 2 and B is 3 per second)

Comparing Rates (continued)

Which rate is greater? (continued)

10. A y = 9x, y km and x hours B 64 km in 8 hours → A (A is 9 and B is 8 per hour)
11. A y = 13x, y meters and x seconds B 49 meters in 7 seconds → A (A is 13 and B is 7 per second)
12. A y = 13x, y words and x minutes B 66 words in 6 minutes → A (A is 13 and B is 11 per minute)
13. A y = 4x, y km and x hours B 30 km in 3 hours → B (A is 4 and B is 10 per hour)
14. A y = 13x, y pages and x days B 18 pages in 2 days → A (A is 13 and B is 9 per day)

How many solutions?

15. −19x − 32 = −32 − 19x: infinitely many
16. 17x − 21 = 17x − 29: no solution
17. 11x − 39 = −39 + 11x: infinitely many
18. 12x + 49 = x + 18: one solution
19. −8x − 5 = −8x: no solution
20. 2x − 24 = −7x + 1: one solution
21. −20x + 25 = −20x + 20: no solution
22. 2x − 6 = 2x − 4: no solution
23. 18x − 54 = −54 + 18x: infinitely many
24. x − 33 = 15x − 39: one solution

Is It Linear?

Linear or nonlinear

1. y = 11x + 24: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
2. $y = x^2 + 16$: Nonlinear — x is squared, so the steps in y grow as x grows
3. y = 61/x: Nonlinear — x is underneath, so doubling x halves y instead of adding the same amount again
4. y = 16x + 22: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
5. $y = 2x^2 + 37$: Nonlinear — x is squared, so the steps in y grow as x grows
6. y = 92: Linear — y is always 92 whatever x does — that graph is a flat line, and flat is a slope of zero rather than no slope
7. y = 12x + 26: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
8. $y = 2x^2 + 20$: Nonlinear — x is squared, so the steps in y grow as x grows
9. y = 49/x: Nonlinear — x is underneath, so doubling x halves y instead of adding the same amount again
10. y = 7x − 9: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
11. $y = 11x^3 + 32$: Nonlinear — x is cubed, so the steps in y grow as x grows
12. y = 20/x: Nonlinear — x is underneath, so doubling x halves y instead of adding the same amount again

Answer Key (3 of 4)

Is It Linear? (continued)

Linear or nonlinear (continued)

13. y = 20: Linear — y is always 20 whatever x does — that graph is a flat line, and flat is a slope of zero rather than no slope
14. y = 9x + 15: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
15. $y = 6x^3 + 22$: Nonlinear — x is cubed, so the steps in y grow as x grows
16. y = 86: Linear — y is always 86 whatever x does — that graph is a flat line, and flat is a slope of zero rather than no slope
17. $y = 5x^2 + 18$: Nonlinear — x is squared, so the steps in y grow as x grows
18. y = 95/x: Nonlinear — x is underneath, so doubling x halves y instead of adding the same amount again
19. y = 13x − 42: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
20. y = 35: Linear — y is always 35 whatever x does — that graph is a flat line, and flat is a slope of zero rather than no slope
21. $y = x^3 + 31$: Nonlinear — x is cubed, so the steps in y grow as x grows
22. y = 24x − 16: Linear — x is only multiplied by a number and added to, so equal steps in x give equal steps in y
23. y = 35/x: Nonlinear — x is underneath, so doubling x halves y instead of adding the same amount again
24. $y = 3x^2 + 12$: Nonlinear — x is squared, so the steps in y grow as x grows

Finding the slope

25. y = 10x + 30 → m = 10
26. y = −6x + 33 → m = −6
27. y = 8x + 22 → m = 8
28. y = −4x − 25 → m = −4
29. y = −14 → m = 0
30. y = 12x + 36 → m = 12
31. y = −8x + 35 → m = −8
32. y = x − 27 → m = 1
33. y = 9x + 9 → m = 9
34. y = −2x − 26 → m = −2
35. y = 9x + 19 → m = 9
36. y = x + 26 → m = 1
37. y = −x + 20 → m = −1
38. y = −x + 22 → m = −1
39. y = −12x − 24 → m = −12
40. y = −12x − 30 → m = −12
41. y = 9x + 23 → m = 9
42. y = x + 25 → m = 1
43. y = −12x + 10 → m = −12

Is It Linear? (continued)

Finding the slope (continued)

44. y = −11x − 27 → m = −11

Is It a Function?

Is it a function?

1. (5, 17) (22, 17) (2, 44) (12, 35): Yes — every input appears once — 17 turns up twice, but that is an output, and two inputs may land on the same one
2. (0, 20) (11, 32) (0, 60) (18, 16): No — the input 0 goes to 20 and also to 60, and one input may only go to one place
3. (14, 47) (19, 23) (0, 34) (7, 34): Yes — every input appears once — 34 turns up twice, but that is an output, and two inputs may land on the same one
4. (9, 58) (0, 29) (9, 45) (10, 35): No — the input 9 goes to 58 and also to 45, and one input may only go to one place
5. (1, 59) (24, 52) (6, 54) (11, 59): Yes — every input appears once — 59 turns up twice, but that is an output, and two inputs may land on the same one
6. (11, 52) (16, 47) (10, 10) (7, 52): Yes — every input appears once — 52 turns up twice, but that is an output, and two inputs may land on the same one
7. (1, 55) (6, 29) (6, 17) (20, 18): No — the input 6 goes to 29 and also to 17, and one input may only go to one place
8. (11, 32) (18, 5) (10, 32) (17, 41): Yes — every input appears once — 32 turns up twice, but that is an output, and two inputs may land on the same one
9. (8, 22) (16, 49) (24, 24) (8, 17): No — the input 8 goes to 22 and also to 17, and one input may only go to one place
10. (0, 47) (9, 46) (10, 16) (2, 46): Yes — every input appears once — 46 turns up twice, but that is an output, and two inputs may land on the same one
11. (9, 11) (15, 45) (21, 45) (13, 52): Yes — every input appears once — 45 turns up twice, but that is an output, and two inputs may land on the same one
12. (1, 7) (18, 32) (12, 45) (18, 52): No — the input 18 goes to 32 and also to 52, and one input may only go to one place
13. (17, 1) (20, 3) (9, 1) (19, 44): Yes — every input appears once — 1 turns up twice, but that is an output, and two inputs may land on the same one
14. (6, 43) (6, 40) (16, 56) (20, 25): No — the input 6 goes to 43 and also to 40, and one input may only go to one place

Finding the slope

15. y = 12x + 1 → m = 12
16. y = 10x + 36 → m = 10
17. y = 11x − 16 → m = 11
18. y = 6x − 26 → m = 6
19. y = −4x − 20 → m = −4
20. y = 5x − 16 → m = 5

Answer Key (4 of 4)

Is It a Function? (continued)

Finding the slope (continued)

21. $y = 12x + 36 \rightarrow m = 12$
22. $y = -8x + 35 \rightarrow m = -8$
23. $y = x - 27 \rightarrow m = 1$
24. $y = -6x - 19 \rightarrow m = -6$

Solutions (1 of 9)

Slope

Finding the slope

1. **y = 10x + 28 m = ___**

y = 10x + 28

m = **10**

A line written this way carries two facts: how much y moves for each step of x, and where it already is when x is 0. The slope is the first.

The number multiplying x is 10, so each step of x moves y by 10.

So m = 10, and the 28 is where it starts rather than how it climbs.

2. **y = 12x + 1 m = ___**

y = 12x + 1

m = **12**

A line written this way carries two facts: how much y moves for each step of x, and where it already is when x is 0. The slope is the first.

The number multiplying x is 12, so each step of x moves y by 12.

So m = 12, and the 1 is where it starts rather than how it climbs.

Solving equations

49. **4x + 37 = 10x + 13 ___**

4x + 37 = 10x + 13

53 = 53 ✓

This one has x on BOTH sides, so nothing can be undone yet — subtracting 37 would still leave an x on the right. Collect the x terms first.

Take 4x off BOTH sides. That clears x from the left, leaving 37 = 6x + 13. An equals sign does not care which side is which, so write it as 6x + 13 = 37. That is an equation you have already met.

Two things were done to x: multiplied by 6, then 13 added. Undo them in the REVERSE order — whatever happened last comes off first.

The 13 went on last, so it comes off first — and off BOTH sides, or the two halves stop being equal. 37 − 13 = 24.

That leaves 6x, which means 6 lots of x. Divide both sides by 6: 24 ÷ 6 = 4.

Check by putting it back into the ORIGINAL, both sides: 4(4) + 37 = 53, and 10(4) + 13 = 53 — both 53, so x = 4.

Solutions (2 of 9)

Slope (continued)

Solving equations (continued)

50. **8x + 10 = 6x + 12** ___

$$8x + 10 = 6x + 12$$

$$\mathbf{18 = 18} \quad \checkmark$$

This one has x on BOTH sides, so nothing can be undone yet — subtracting 10 would still leave an x on the right. Collect the x terms first.

Take 6x off BOTH sides. That clears x from the right, leaving 2x + 10 = 12. That is an equation you have already met.

Two things were done to x: multiplied by 2, then 10 added. Undo them in the REVERSE order — whatever happened last comes off first.

The 10 went on last, so it comes off first — and off BOTH sides, or the two halves stop being equal. 12 – 10 = 2.

That leaves 2x, which means 2 lots of x. Divide both sides by 2: 2 ÷ 2 = 1.

Check by putting it back into the ORIGINAL, both sides: 8(1) + 10 = 18, and 6(1) + 12 = 18 — both 18, so x = 1.

Solutions (3 of 9)

Rate of Change

Rate of change from a table

1.

x	1	2	3	4
y	42	33	24	15

rate → ___

rate of change = –9

Rate of change means how much y moves for every ONE x. So it is a division, and the two things being divided are both differences: how far y went, over how far x went.

Take both rows of steps. x moves 1, 1, 1 — the same each time — and y moves –9, –9, –9. They are steady, so this table really does have one rate rather than a different one in every gap.

Written out, that is one step of each: y moved –9 while x moved 1. Those two numbers are the whole of the division below.

Now divide: –9 ÷ 1 = –9. Dividing by one changes nothing, which is exactly why it is worth writing down — on a table whose x steps by more, it will not.

So the rate of change is –9: y moves –9 while x moves 1, and –9 ÷ 1 = –9.

Solutions (4 of 9)

Rate of Change (continued)

Rate of change from a table (continued)

2.

x	1	4	7	10
y	33	48	63	78

rate → ___

rate of change = 5

Rate of change means how much y moves for every ONE x. So it is a division, and the two things being divided are both differences: how far y went, over how far x went.

Take both rows of steps. x moves 3, 3, 3 — the same each time — and y moves 15, 15, 15. They are steady, so this table really does have one rate rather than a different one in every gap.

Written out, that is one step of each: y moved 15 while x moved 3. Those two numbers are the whole of the division below.

Now divide: 15 ÷ 3 = 5. This is the step that gets skipped — 15 is how far y went over 3 of them, not over one.

So the rate of change is 5: y moves 15 while x moves 3, and 15 ÷ 3 = 5.

Solutions (5 of 9)

Rate of Change (continued)

Systems of equations

25. $11x + 9y = -4$
$-8x - 9y = -29$

$x = -11$

$y = 13$

Two equations, two letters. Neither one can be solved on its own — so the first move, whichever method you use, is to get down to ONE equation with ONE letter in it.

Look at the y terms: 9y in the first and −9y in the second. They are opposites, so adding the two equations makes them cancel.

Adding is allowed because both sides of each equation are equal — adding left to left and right to right keeps the balance, the same as adding a number to both sides. That gives $3x = -33$.

One letter left. $-33 \div 3 = -11$, so $x = -11$.

Now put x back into either equation to get y — this is the half that gets forgotten. It gives $y = 13$, so the solution is $(-11, 13)$.

Solutions (6 of 9)

Rate of Change (continued)

Systems of equations (continued)

26. **3x + 6y = −18**
4x − 6y = 18

x = 0

y = **−3**

Two equations, two letters. Neither one can be solved on its own — so the first move, whichever method you use, is to get down to ONE equation with ONE letter in it.

Look at the y terms: 6y in the first and −6y in the second. They are opposites, so adding the two equations makes them cancel.

Adding is allowed because both sides of each equation are equal — adding left to left and right to right keeps the balance, the same as adding a number to both sides. That gives 7x = 0.

One letter left. 0 ÷ 7 = 0, so x = 0.

Now put x back into either equation to get y — this is the half that gets forgotten. It gives y = −3, so the solution is (0, −3).

Comparing Rates

Which rate is greater?

1. **A y = 10x, y meters and x seconds**
B 39 meters in 3 seconds **A / B**

A 10 **B 13**

greater: **B**

These two are written in different ways, so there is nothing to compare yet — the numbers on the page are not the same kind of number. Turn each one into a rate PER ONE second first, and do not look at which looks bigger until you have.

A: the number in front of x, which is already a rate per one second: 10. So A is 10 meters per second.

B: 39 ÷ 3 = 13. So B is 13 meters per second.

Now they can be compared: A is 10 and B is 13 per second, so B is greater.

Solutions (7 of 9)

Comparing Rates (continued)

Which rate is greater? (continued)

2. A **84 km in 7 hours**
   B **y = 6x, y km and x hours**
   A / B

A 12 B 6

greater: A

These two are written in different ways, so there is nothing to compare yet — the numbers on the page are not the same kind of number. Turn each one into a rate PER ONE hour first, and do not look at which looks bigger until you have.

A: 84 ÷ 7 = 12. So A is 12 km per hour.

B: the number in front of x, which is already a rate per one hour: 6. So B is 6 km per hour.

Now they can be compared: A is 12 and B is 6 per hour, so A is greater.

How many solutions?

15. **−19x − 32 = −32 − 19x**

−32 = −32 **is true**

infinitely many solutions

Do not start by hunting for x. Ask a smaller question first: what is left when the x terms are collected on one side?

Both sides have the SAME number of x, so taking it off both sides removes x completely. That is not a mistake — it is the answer arriving early.

What is left is −32 = −32, which is true whatever x is. So every number works — infinitely many solutions.

16. **17x − 21 = 17x − 29**

−21 = −29 **is false**

no solution

Do not start by hunting for x. Ask a smaller question first: what is left when the x terms are collected on one side?

Both sides have the SAME number of x, so taking it off both sides removes x completely. That is not a mistake — it is the answer arriving early.

What is left is −21 = −29, which is never true, whatever x is. So there is no solution.

Solutions (8 of 9)

Is It Linear?

Linear or nonlinear

1. **$y = 11x + 24$** **Linear** / **Nonlinear**

Linear or nonlinear? **Linear**

Linear means the graph is a straight line, and one thing decides it: what is being DONE to x. Multiplied by a number and added to — that is a line. Anything else is not.

Look at what happens to x: it is multiplied by a number, and a number is added or taken away. Nothing else is done to it.

That is exactly the mx + b shape — x is only multiplied by a number and added to, so equal steps in x give equal steps in y. It is a line.

2. **$y = x^2 + 16$** **Linear** / **Nonlinear**

Linear or nonlinear?

Nonlinear

Linear means the graph is a straight line, and one thing decides it: what is being DONE to x. Multiplied by a number and added to — that is a line. Anything else is not.

Look at what x is carrying: it is squared. Squaring is not multiplying by a fixed number — going from x = 1 to 2 to 3 gives 1, 4, 9, and those gaps are 3 then 5.

So equal steps in x do NOT give equal steps in y: x is squared, so the steps in y grow as x grows. The graph curves, so it is not a line.

Solutions (9 of 9)

Is It a Function?

Is it a function?

1.

x	5	22	2	12
y	17	17	44	35

inputs 5, 22, 2, 12 — no repeat

A function

A function has one rule: every input gets exactly ONE output. So there is only one column to check — the inputs, which are the top row of the table.

Pull the inputs out on their own and look at them together: 5, 22, 2, 12. Nothing about the outputs matters yet.

Now the check: every input appears once — 17 turns up twice, but that is an output, and two inputs may land on the same one.

Two different inputs are ALLOWED to land on the same output — the way both 2 and −2 square to 4, or every hour of a flat day has the same temperature. It is the input column that may not repeat, and it is the only one.

Every input has exactly one output, so this relation is a function.

2.

x	0	11	0	18
y	20	32	60	16

0 → 20 and 0 → 60

Not a function

A function has one rule: every input gets exactly ONE output. So there is only one column to check — the inputs, which are the top row of the table.

Pull the inputs out on their own and look at them together: 0, 11, 0, 18. Nothing about the outputs matters yet.

0 is in that list twice, and the two pairs it belongs to do not agree: the input 0 goes to 20 and also to 60, and one input may only go to one place.

One input, two different outputs. That is the one thing a function is not allowed to do, so this relation is not a function.