

Grade 6 Factors, Multiples and Exponents Workbook

5 lessons · printable · answer key at the back

Name _____ Date _____

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Exponents

1. Exponents

Find the value of each square.

- | | | | | |
|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|
| 1 $3^2 = \underline{\hspace{2cm}}$ | 2 $17^2 = \underline{\hspace{2cm}}$ | 3 $5^2 = \underline{\hspace{2cm}}$ | 4 $8^2 = \underline{\hspace{2cm}}$ | 5 $10^2 = \underline{\hspace{2cm}}$ |
| 6 $7^2 = \underline{\hspace{2cm}}$ | 7 $4^2 = \underline{\hspace{2cm}}$ | 8 $15^2 = \underline{\hspace{2cm}}$ | 9 $19^2 = \underline{\hspace{2cm}}$ | 10 $9^2 = \underline{\hspace{2cm}}$ |
| 11 $14^2 = \underline{\hspace{2cm}}$ | 12 $12^2 = \underline{\hspace{2cm}}$ | 13 $2^2 = \underline{\hspace{2cm}}$ | 14 $18^2 = \underline{\hspace{2cm}}$ | 15 $6^2 = \underline{\hspace{2cm}}$ |
| 16 $16^2 = \underline{\hspace{2cm}}$ | 17 $13^2 = \underline{\hspace{2cm}}$ | 18 $20^2 = \underline{\hspace{2cm}}$ | 19 $11^2 = \underline{\hspace{2cm}}$ | |

2. Add and subtract integers

Add or subtract the integers.

- | | | | |
|--|--|---|---|
| 20 $-4 + 9 = \underline{\hspace{2cm}}$ | 21 $-20 + 2 = \underline{\hspace{2cm}}$ | 22 $3 - 11 = \underline{\hspace{2cm}}$ | 23 $-20 + 7 = \underline{\hspace{2cm}}$ |
| 24 $-3 + 2 = \underline{\hspace{2cm}}$ | 25 $6 - 8 = \underline{\hspace{2cm}}$ | 26 $-1 + 7 = \underline{\hspace{2cm}}$ | 27 $-6 + 7 = \underline{\hspace{2cm}}$ |
| 28 $4 - 13 = \underline{\hspace{2cm}}$ | 29 $-8 + 1 = \underline{\hspace{2cm}}$ | 30 $-2 + 12 = \underline{\hspace{2cm}}$ | 31 $-15 + 6 = \underline{\hspace{2cm}}$ |
| 32 $-13 + 6 = \underline{\hspace{2cm}}$ | 33 $-19 + 11 = \underline{\hspace{2cm}}$ | 34 $-7 + 9 = \underline{\hspace{2cm}}$ | 35 $-16 + 3 = \underline{\hspace{2cm}}$ |
| 36 $-12 + 11 = \underline{\hspace{2cm}}$ | 37 $-5 + 8 = \underline{\hspace{2cm}}$ | 38 $-9 + 1 = \underline{\hspace{2cm}}$ | 39 $2 - 11 = \underline{\hspace{2cm}}$ |

Greatest Common Factor

WORKED EXAMPLE

16, 28 → 4

3. Greatest common factor

Find the greatest common factor (GCF) of each set of numbers.

- | | | | |
|------------------|------------------|------------------|------------------|
| 1 6, 15 → ____ | 2 20, 24 → ____ | 3 12, 15 → ____ | 4 8, 12 → ____ |
| 5 25, 30 → ____ | 6 4, 6 → ____ | 7 15, 21 → ____ | 8 8, 10 → ____ |
| 9 9, 21 → ____ | 10 8, 14 → ____ | 11 10, 35 → ____ | 12 4, 14 → ____ |
| 13 8, 20 → ____ | 14 6, 8 → ____ | 15 6, 14 → ____ | 16 20, 28 → ____ |
| 17 10, 25 → ____ | 18 12, 14 → ____ | 19 10, 12 → ____ | 20 16, 20 → ____ |
| 21 12, 30 → ____ | 22 9, 15 → ____ | 23 15, 25 → ____ | 24 6, 9 → ____ |
| 25 30, 35 → ____ | 26 9, 12 → ____ | 27 12, 21 → ____ | 28 10, 15 → ____ |
| 29 24, 28 → ____ | 30 6, 10 → ____ | 31 20, 25 → ____ | 32 4, 10 → ____ |
| 33 12, 18 → ____ | 34 10, 14 → ____ | 35 25, 35 → ____ | 36 12, 16 → ____ |
| 37 30, 36 → ____ | 38 15, 18 → ____ | 39 8, 28 → ____ | 40 6, 21 → ____ |
| 41 15, 35 → ____ | 42 18, 21 → ____ | 43 12, 20 → ____ | 44 12, 28 → ____ |
| 45 18, 24 → ____ | 46 18, 30 → ____ | 47 15, 20 → ____ | 48 24, 30 → ____ |

4. Prime or composite

Circle whether each number is prime or composite.

- | | |
|-------------------------|-------------------------|
| 49 4 Prime / Composite | 50 17 Prime / Composite |
| 51 28 Prime / Composite | 52 8 Prime / Composite |
| 53 45 Prime / Composite | 54 18 Prime / Composite |
| 55 44 Prime / Composite | 56 16 Prime / Composite |
| 57 5 Prime / Composite | 58 20 Prime / Composite |
| 59 41 Prime / Composite | 60 30 Prime / Composite |
| 61 38 Prime / Composite | 62 34 Prime / Composite |
| 63 10 Prime / Composite | 64 9 Prime / Composite |
| 65 3 Prime / Composite | 66 22 Prime / Composite |
| 67 14 Prime / Composite | 68 19 Prime / Composite |

Lowest Common Multiple

5. Least common multiple

Find the least common multiple (LCM) of each set of numbers.

- | | | | |
|------------------|------------------|------------------|------------------|
| 1 6, 8 → ____ | 2 9, 15 → ____ | 3 8, 12 → ____ | 4 12, 20 → ____ |
| 5 4, 6 → ____ | 6 10, 25 → ____ | 7 4, 10 → ____ | 8 15, 20 → ____ |
| 9 9, 12 → ____ | 10 6, 9 → ____ | 11 15, 25 → ____ | 12 6, 10 → ____ |
| 13 8, 20 → ____ | 14 16, 20 → ____ | 15 6, 15 → ____ | 16 12, 16 → ____ |
| 17 10, 15 → ____ | 18 12, 15 → ____ | 19 8, 10 → ____ | 20 20, 25 → ____ |

6. Greatest common factor

Find the greatest common factor (GCF) of each set of numbers.

- | | | | |
|------------------|------------------|------------------|------------------|
| 21 8, 14 → ____ | 22 6, 21 → ____ | 23 10, 15 → ____ | 24 30, 35 → ____ |
| 25 6, 9 → ____ | 26 12, 21 → ____ | 27 8, 10 → ____ | 28 20, 35 → ____ |
| 29 15, 21 → ____ | 30 12, 14 → ____ | 31 10, 35 → ____ | 32 6, 15 → ____ |
| 33 10, 25 → ____ | 34 18, 30 → ____ | 35 10, 12 → ____ | 36 20, 24 → ____ |
| 37 6, 10 → ____ | 38 24, 30 → ____ | 39 12, 16 → ____ | 40 4, 10 → ____ |

Factors and Multiples

WORKED EXAMPLE

31 → 1, 31

7. List the factors

List all the factors of each number.

- 1 2 → _____
- 2 6 → _____
- 3 28 → _____
- 4 29 → _____
- 5 38 → _____
- 6 32 → _____
- 7 3 → _____
- 8 26 → _____
- 9 40 → _____
- 10 17 → _____
- 11 10 → _____
- 12 12 → _____

8. Is it a multiple?

Circle Yes or No for each question.

- 13 Is 16 a multiple of 4? Yes / No
- 14 Is 20 a multiple of 10? Yes / No
- 15 Is 32 a multiple of 8? Yes / No
- 16 Is 14 a multiple of 2? Yes / No
- 17 Is 24 a multiple of 4? Yes / No
- 18 Is 36 a multiple of 9? Yes / No
- 19 Is 5 a multiple of 5? Yes / No
- 20 Is 27 a multiple of 2? Yes / No
- 21 Is 36 a multiple of 6? Yes / No
- 22 Is 16 a multiple of 2? Yes / No

Prime and Composite Numbers

WORKED EXAMPLE

18 Prime /

Composite

9. Prime or composite

Circle whether each number is prime or composite.

1 3 Prime / Composite

2 22 Prime / Composite

3 47 Prime / Composite

4 11 Prime / Composite

5 45 Prime / Composite

6 13 Prime / Composite

7 39 Prime / Composite

8 20 Prime / Composite

9 9 Prime / Composite

10 40 Prime / Composite

11 35 Prime / Composite

12 25 Prime / Composite

13 5 Prime / Composite

14 27 Prime / Composite

15 36 Prime / Composite

16 43 Prime / Composite

17 23 Prime / Composite

18 49 Prime / Composite

19 44 Prime / Composite

20 31 Prime / Composite

21 29 Prime / Composite

22 2 Prime / Composite

23 37 Prime / Composite

24 41 Prime / Composite

25 32 Prime / Composite

26 46 Prime / Composite

27 15 Prime / Composite

28 21 Prime / Composite

29 7 Prime / Composite

30 33 Prime / Composite

31 38 Prime / Composite

32 12 Prime / Composite

33 50 Prime / Composite

34 6 Prime / Composite

35 17 Prime / Composite

36 48 Prime / Composite

10. Multiplying integers

Multiply. Remember what two negative signs make.

37 $-3 \times 12 = \underline{\hspace{2cm}}$

38 $-12 \times 4 = \underline{\hspace{2cm}}$

39 $-6 \times (-10) = \underline{\hspace{2cm}}$

40 $-2 \times 11 = \underline{\hspace{2cm}}$

41 $-7 \times (-5) = \underline{\hspace{2cm}}$

42 $-7 \times 11 = \underline{\hspace{2cm}}$

10. Multiplying integers (continued)

Multiply. Remember what two negative signs make.

43 $-11 \times (-7) = \underline{\hspace{2cm}}$

44 $-10 \times 2 = \underline{\hspace{2cm}}$

45 $-5 \times (-4) = \underline{\hspace{2cm}}$

46 $8 \times (-7) = \underline{\hspace{2cm}}$

Answer Key (1 of 3)

Exponents

Exponents

1. $3^2 = 9$
2. $17^2 = 289$
3. $5^2 = 25$
4. $8^2 = 64$
5. $10^2 = 100$
6. $7^2 = 49$
7. $4^2 = 16$
8. $15^2 = 225$
9. $19^2 = 361$
10. $9^2 = 81$
11. $14^2 = 196$
12. $12^2 = 144$
13. $2^2 = 4$
14. $18^2 = 324$
15. $6^2 = 36$
16. $16^2 = 256$
17. $13^2 = 169$
18. $20^2 = 400$
19. $11^2 = 121$

Add and subtract integers

20. $-4 + 9 = 5$
21. $-20 + 2 = -18$
22. $3 - 11 = -8$
23. $-20 + 7 = -13$
24. $-3 + 2 = -1$
25. $6 - 8 = -2$
26. $-1 + 7 = 6$
27. $-6 + 7 = 1$
28. $4 - 13 = -9$
29. $-8 + 1 = -7$
30. $-2 + 12 = 10$
31. $-15 + 6 = -9$
32. $-13 + 6 = -7$
33. $-19 + 11 = -8$
34. $-7 + 9 = 2$
35. $-16 + 3 = -13$
36. $-12 + 11 = -1$
37. $-5 + 8 = 3$
38. $-9 + 1 = -8$
39. $2 - 11 = -9$

Greatest Common Factor

Greatest common factor

1. $6, 15 \rightarrow 3$
2. $20, 24 \rightarrow 4$

Greatest Common Factor (continued)

Greatest common factor (continued)

3. $12, 15 \rightarrow 3$
4. $8, 12 \rightarrow 4$
5. $25, 30 \rightarrow 5$
6. $4, 6 \rightarrow 2$
7. $15, 21 \rightarrow 3$
8. $8, 10 \rightarrow 2$
9. $9, 21 \rightarrow 3$
10. $8, 14 \rightarrow 2$
11. $10, 35 \rightarrow 5$
12. $4, 14 \rightarrow 2$
13. $8, 20 \rightarrow 4$
14. $6, 8 \rightarrow 2$
15. $6, 14 \rightarrow 2$
16. $20, 28 \rightarrow 4$
17. $10, 25 \rightarrow 5$
18. $12, 14 \rightarrow 2$
19. $10, 12 \rightarrow 2$
20. $16, 20 \rightarrow 4$
21. $12, 30 \rightarrow 6$
22. $9, 15 \rightarrow 3$
23. $15, 25 \rightarrow 5$
24. $6, 9 \rightarrow 3$
25. $30, 35 \rightarrow 5$
26. $9, 12 \rightarrow 3$
27. $12, 21 \rightarrow 3$
28. $10, 15 \rightarrow 5$
29. $24, 28 \rightarrow 4$
30. $6, 10 \rightarrow 2$
31. $20, 25 \rightarrow 5$
32. $4, 10 \rightarrow 2$
33. $12, 18 \rightarrow 6$
34. $10, 14 \rightarrow 2$
35. $25, 35 \rightarrow 5$
36. $12, 16 \rightarrow 4$
37. $30, 36 \rightarrow 6$
38. $15, 18 \rightarrow 3$
39. $8, 28 \rightarrow 4$
40. $6, 21 \rightarrow 3$
41. $15, 35 \rightarrow 5$
42. $18, 21 \rightarrow 3$
43. $12, 20 \rightarrow 4$
44. $12, 28 \rightarrow 4$
45. $18, 24 \rightarrow 6$
46. $18, 30 \rightarrow 6$
47. $15, 20 \rightarrow 5$

Answer Key (2 of 3)

Greatest Common Factor (continued)

Greatest common factor (continued)

48. 24, 30 → 6

Prime or composite

49. 4 → Composite (2×2)

50. 17 → Prime

51. 28 → Composite (2×14)

52. 8 → Composite (2×4)

53. 45 → Composite (3×15)

54. 18 → Composite (2×9)

55. 44 → Composite (2×22)

56. 16 → Composite (2×8)

57. 5 → Prime

58. 20 → Composite (2×10)

59. 41 → Prime

60. 30 → Composite (2×15)

61. 38 → Composite (2×19)

62. 34 → Composite (2×17)

63. 10 → Composite (2×5)

64. 9 → Composite (3×3)

65. 3 → Prime

66. 22 → Composite (2×11)

67. 14 → Composite (2×7)

68. 19 → Prime

Lowest Common Multiple

Least common multiple

1. 6, 8 → 24

2. 9, 15 → 45

3. 8, 12 → 24

4. 12, 20 → 60

5. 4, 6 → 12

6. 10, 25 → 50

7. 4, 10 → 20

8. 15, 20 → 60

9. 9, 12 → 36

10. 6, 9 → 18

11. 15, 25 → 75

12. 6, 10 → 30

13. 8, 20 → 40

14. 16, 20 → 80

15. 6, 15 → 30

16. 12, 16 → 48

17. 10, 15 → 30

18. 12, 15 → 60

19. 8, 10 → 40

20. 20, 25 → 100

Lowest Common Multiple (continued)

Greatest common factor

21. 8, 14 → 2

22. 6, 21 → 3

23. 10, 15 → 5

24. 30, 35 → 5

25. 6, 9 → 3

26. 12, 21 → 3

27. 8, 10 → 2

28. 20, 35 → 5

29. 15, 21 → 3

30. 12, 14 → 2

31. 10, 35 → 5

32. 6, 15 → 3

33. 10, 25 → 5

34. 18, 30 → 6

35. 10, 12 → 2

36. 20, 24 → 4

37. 6, 10 → 2

38. 24, 30 → 6

39. 12, 16 → 4

40. 4, 10 → 2

Factors and Multiples

List the factors

1. 2 → 1, 2

2. 6 → 1, 2, 3, 6

3. 28 → 1, 2, 4, 7, 14, 28

4. 29 → 1, 29

5. 38 → 1, 2, 19, 38

6. 32 → 1, 2, 4, 8, 16, 32

7. 3 → 1, 3

8. 26 → 1, 2, 13, 26

9. 40 → 1, 2, 4, 5, 8, 10, 20, 40

10. 17 → 1, 17

11. 10 → 1, 2, 5, 10

12. 12 → 1, 2, 3, 4, 6, 12

Is it a multiple?

13. Is 16 a multiple of 4? → Yes

14. Is 20 a multiple of 10? → Yes

15. Is 32 a multiple of 8? → Yes

16. Is 14 a multiple of 2? → Yes

17. Is 24 a multiple of 4? → Yes

18. Is 36 a multiple of 9? → Yes

19. Is 5 a multiple of 5? → Yes

20. Is 27 a multiple of 2? → No

21. Is 36 a multiple of 6? → Yes

Answer Key (3 of 3)

Factors and Multiples (continued)

Is it a multiple? (continued)

22. Is 16 a multiple of 2? → Yes

Prime and Composite Numbers

Prime or composite

1. 3 → Prime
2. 22 → Composite (2×11)
3. 47 → Prime
4. 11 → Prime
5. 45 → Composite (3×15)
6. 13 → Prime
7. 39 → Composite (3×13)
8. 20 → Composite (2×10)
9. 9 → Composite (3×3)
10. 40 → Composite (2×20)
11. 35 → Composite (5×7)
12. 25 → Composite (5×5)
13. 5 → Prime
14. 27 → Composite (3×9)
15. 36 → Composite (2×18)
16. 43 → Prime
17. 23 → Prime
18. 49 → Composite (7×7)
19. 44 → Composite (2×22)
20. 31 → Prime
21. 29 → Prime
22. 2 → Prime
23. 37 → Prime
24. 41 → Prime
25. 32 → Composite (2×16)
26. 46 → Composite (2×23)
27. 15 → Composite (3×5)
28. 21 → Composite (3×7)
29. 7 → Prime
30. 33 → Composite (3×11)
31. 38 → Composite (2×19)
32. 12 → Composite (2×6)
33. 50 → Composite (2×25)
34. 6 → Composite (2×3)
35. 17 → Prime
36. 48 → Composite (2×24)

Multiplying integers

37. $-3 \times 12 = -36$
38. $-12 \times 4 = -48$

Prime and Composite Numbers (continued)

Multiplying integers (continued)

39. $-6 \times -10 = 60$
40. $-2 \times 11 = -22$
41. $-7 \times -5 = 35$
42. $-7 \times 11 = -77$
43. $-11 \times -7 = 77$
44. $-10 \times 2 = -20$
45. $-5 \times -4 = 20$
46. $8 \times -7 = -56$

Solutions (1 of 5)

Exponents

Exponents

1. $3^2 = \underline{\quad}$

$$3^2 = 3 \times 3$$

$$3 \times 3 = \mathbf{9}$$

The small number is a COUNT, not something to multiply by. 3^2 does not mean 3×2 — it means how many 3s to multiply together.

So write it out: 2 3s multiplied together — 3×3 .

Now it is just multiplying: $3 \times 3 = 9$.

2. $17^2 = \underline{\quad}$

$$17^2 = 17 \times 17$$

$$17 \times 17 = \mathbf{289}$$

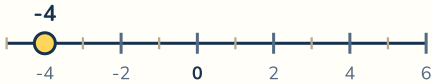
The small number is a COUNT, not something to multiply by. 17^2 does not mean 17×2 — it means how many 17s to multiply together.

So write it out: 2 17s multiplied together — 17×17 .

Now it is just multiplying: $17 \times 17 = 289$.

Add and subtract integers

20. $-4 + 9 = \underline{\quad}$



Put a counter on -4. Everything else is which way it slides and how far.

Adding a positive moves right, the way it always has.

So slide 9 to the right, from -4 to 5. $(-4) + 9 = 5$.

21. $-20 + 2 = \underline{\quad}$



Put a counter on -20. Everything else is which way it slides and how far.

Adding a positive moves right, the way it always has.

So slide 2 to the right, from -20 to -18. $(-20) + 2 = -18$.

Solutions (2 of 5)

Greatest Common Factor

Greatest common factor

1. 6, 15 → ____

6: 1 2 3 6
15: 1 3 5 15
GCF = 3

A factor is a number that divides in exactly. List every factor of 6.

Now every factor of 15.

Some appear in BOTH lists — 1, 3. Those are the common factors.

The greatest of them is 3, so the GCF of 6 and 15 is 3.

2. 20, 24 → ____

20: 1 2 4 5 10 20
24: 1 2 3 4 6 8 12
24
GCF = 4

A factor is a number that divides in exactly. List every factor of 20.

Now every factor of 24.

Some appear in BOTH lists — 1, 2, 4. Those are the common factors.

The greatest of them is 4, so the GCF of 20 and 24 is 4.

Prime or composite

49. 4 Prime / Composite

tried: 2
 $4 \div 2 = 2$

A prime has exactly two factors: 1 and itself. So the question is whether anything ELSE divides into 4.

You do not have to try everything up to 4. Factors come in pairs, so if one were bigger than 2 its partner would be smaller — and you would have found that one first. Testing up to 2 is enough.

2 goes into 4 exactly ($4 \div 2 = 2$), and that is one factor too many. 4 is composite — no need to test any further.

Solutions (3 of 5)

Greatest Common Factor (continued)

Prime or composite (continued)

50. **17** Prime / Composite

tried: 2 3 4

17: **1** **17**

A prime has exactly two factors: 1 and itself. So the question is whether anything ELSE divides into 17.

You do not have to try everything up to 17. Factors come in pairs, so if one were bigger than 4 its partner would be smaller — and you would have found that one first. Testing up to 4 is enough.

Try each in turn — 2, 3, 4 — and none of them goes in exactly.

Nothing under 5 divides in, so nothing above it can either. 17 has only 1 and 17 — it is prime.

Lowest Common Multiple

Least common multiple

1. **6, 8** → ____

6: 6 12 18 **24**

8: 8 16 **24**

LCM = **24**

Count up in 6s.

Now count up in 8s.

24 turns up in every list — it is the first number all of them reach.

Nothing smaller is in all of them, so 24 is the least common multiple.

2. **9, 15** → ____

9: 9 18 27 36 **45**

15: 15 30 **45**

LCM = **45**

Count up in 9s.

Now count up in 15s.

45 turns up in every list — it is the first number all of them reach.

Nothing smaller is in all of them, so 45 is the least common multiple.

Solutions (4 of 5)

Factors and Multiples

List the factors

1. 2 → _____

so far: 1 2

Factors come in PAIRS — every one you find hands you a second. So work in from both ends rather than trying every number in turn.

$1 \times 2 = 2$, so 1 and 2 are both factors.

The pair has met in the middle, so the list is finished: 1, 2. 2 factors.

2. 6 → _____

so far: 1 2 3 6

Factors come in PAIRS — every one you find hands you a second. So work in from both ends rather than trying every number in turn.

$1 \times 6 = 6$, so 1 and 6 are both factors.

$2 \times 3 = 6$, so 2 and 3 are both factors.

The pair has met in the middle, so the list is finished: 1, 2, 3, 6. 4 factors.

Is it a multiple?

13. Is 16 a multiple of 4? Yes / No

$$16 \div 4 = 4$$

yes

Multiples of 4 are what you get COUNTING IN 4s — they start at 4 and only get bigger. (Factors are the other way: they go into 4 and are never bigger than it. The two words are swapped more often than either is misunderstood.)

$16 \div 4 = 4$ exactly — nothing left over. Counting in 4s lands on it, so yes.

14. Is 20 a multiple of 10? Yes / No

$$20 \div 10 = 2$$

yes

Multiples of 10 are what you get COUNTING IN 10s — they start at 10 and only get bigger. (Factors are the other way: they go into 10 and are never bigger than it. The two words are swapped more often than either is misunderstood.)

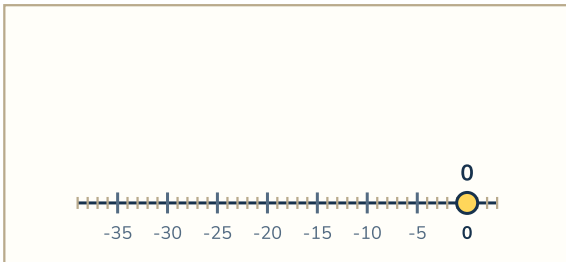
$20 \div 10 = 2$ exactly — nothing left over. Counting in 10s lands on it, so yes.

Solutions (5 of 5)

Prime and Composite Numbers

Multiplying integers

37. $-3 \times 12 = \underline{\hspace{2cm}}$



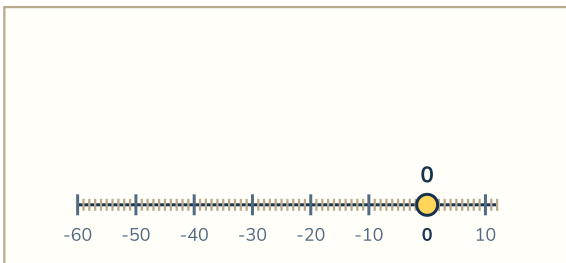
$(-3) \times 12$ is 12 lots of -3 . Start at 0 and take them one at a time — the size is ordinary times-tables, so what is left to settle is which way it goes.

One lot of -3 goes LEFT, landing on -3 .

All 12 hops go the same way — not one of them turns round — so it can only get further from 0, never back towards it. That is the whole of why the answer is below zero.

12 hops of 3 is 36 of distance, all of it on the low side. So $(-3) \times 12 = -36$.

38. $-12 \times 4 = \underline{\hspace{2cm}}$



$(-12) \times 4$ is 4 lots of -12 . Start at 0 and take them one at a time — the size is ordinary times-tables, so what is left to settle is which way it goes.

One lot of -12 goes LEFT, landing on -12 .

All 4 hops go the same way — not one of them turns round — so it can only get further from 0, never back towards it. That is the whole of why the answer is below zero.

4 hops of 12 is 48 of distance, all of it on the low side. So $(-12) \times 4 = -48$.