22. [Equations]

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Skill 22.1 Finding the missing number in equations involving + and – (1).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

EITHER
Use **trial and error:**

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$4 + \boxed{?} = 12$

$4 + \mathbf{8} = 12$

$12 = 12$ (true)

The equation is true, so **8** is the solution.

OR
Use **inverse operations:**

- Consider the operation used to construct the sum or the difference.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: Addition and subtraction are inverse operations. Adding 4 and then subtracting 4 leaves a number unchanged.

Example: $4 + \boxed{?} = 12$

$4 + ? - 4 = 12 - 4$

$? = 8$

Q. $15 - \square = 9$ **A.** *15 – ? = 9*

What number subtracted from 15 gives 9?

Guess ? = 6

15 – 6 = 9

9 = 9 (true)

The solution is ***6****.*

OR *(15) – ? = 9*

~~15~~ – ~~15~~ – ? = 9 – 15

–? = –6

? = ***6***

If 15 was added to the missing number, then do the inverse operation and subtract 15 from both sides of the equation.
Finally, reverse the signs on both sides.

a) $16 - \boxed{7} = 9$ (Use trial and error)

16 – ? = 9

? = 7

b) $7 + \square = 15$

7 + ? = 15

? =

c) $\square + 24 = 30$

? + 24 = 30

? =

d) $14 - \square = 6$

? =

e) $13 - \square = 3$

? =

f) $8 + \square = 21$

? =

g) $\square + 8 = 20$

? =

h) $14 + \square = 21$

? =

i) $\square - 8 = 13$

? =

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Skill 22.1 Finding the missing number in equations involving + and – (2).

Operation: + 18 — Use inverse operations

j) $18 + \boxed{9} = 27$

Inverse of + 18 is – 18

$\cancel{18} + ? - \cancel{18} = 27 - 18$

$? = 9$

k) $\square + 18 = 40$

$? + \cancel{18} - \cancel{18} = 40 - 18$

$? =$

l) $\square + 20 = 25$

$? =$

m) $\square + 6 = 23$

n) $4 + \square = 20$

o) $16 + \square = 27$

p) $15 + \square = 29$

q) $\square + 16 = 34$

r) $\square + 18 = 38$

s) $\square - 7 = 18$

t) $\square - 18 = 15$

u) $\square - 13 = 14$

v) $\square - 31 = 4$

w) $12 - \square = 3$

x) $16 - \square = 9$

y) $24 - \square = 9$

z) $\square - 8 = 16$

zz) $\square - 8 = 12$

continues on page 186

Skill 22.2 Finding the missing number in equations involving · (1).

EITHER

Use **trial and error:**

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$4 \times \boxed{?} = 12$

$4 \times \mathbf{3} = 12$

$12 = 12$ (true)

The equation is true, so **3** is the solution.

OR

Use **inverse operations:**

- Consider the operation used to construct the multiplication or the division.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: Multiplication and division are inverse operations. Multiplying by 4 and then dividing by 4 leaves a number unchanged.

Example: $4 \times \boxed{?} = 12$

$4 \times ? \div 4 = 12 \div 4$

$? = 3$

Q. $\square \times 20 = 100$ **A.** *What number multiplied by 20 gives 100?*

Guess ? = 5

$? \times 20 = 100$

$5 \times 20 = 100$

$100 = 100$ (true)

The solution is ***5****.*

OR

$? \times 20 = 100$

$? \times 20 \div 20 = 100 \div 20$

$? = 5$

If 20 was multiplied by the missing number, then do the inverse operation and divide by 20 both sides of the equation.

Use trial and error

a) $9 \times \boxed{7} = 63$

$9 \times ? = 63$

$? = 7$

b) $10 \times \square = 40$

$10 \times ? = 40$

$? =$

c) $\square \times 8 = 64$

$? =$

d) $\square \times 4 = 24$

$? =$

e) $4 \times \square = 20$

$? =$

f) $7 \times \square = 56$

$? =$

g) $6 \times \square = 12$

$? =$

h) $\square \times 7 = 42$

$? =$

i) $\square \times 8 = 72$

$? =$

continued from page 185

Skill 22.2 Finding the missing number in equations involving · (2).

Operation: × 6 — Use inverse operations

j) $6 \times \boxed{5} = 30$

Inverse of × 6 is ÷ 6

$6 \times ? \div 6 = 30 \div 6$

$? = 5$

k) $\boxed{} \times 5 = 60$

$? \times 5 \div 5 = 60 \div 5$

$? =$

l) $\boxed{} \times 12 = 72$

$? =$

m) $\boxed{} \times 5 = 55$

n) $13 \times \boxed{} = 39$

o) $9 \times \boxed{} = 360$

p) $\boxed{} \times 14 = -28$

q) $-8 \times \boxed{} = -24$

r) $-4 \times \boxed{} = -28$

s) $\boxed{} \times 10 = -30$

t) $-9 \times \boxed{} = -81$

u) $-7 \times \boxed{} = 63$

v) $-9 \times \boxed{} = 18$

w) $\boxed{} \times 5 = -35$

x) $-8 \times \boxed{} = -88$

y) $\boxed{} \times (-3) = -75$

z) $\boxed{} \times (-8) = 16$

zz) $-7 \times \boxed{} = 49$

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Skill 22.3 Finding the missing number in equations involving fractions (1).

EITHER

Use **trial and error:**

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Hint: "of" means multiplication, so use "×"

Example:

$\frac{1}{4}$ of $\boxed{?} = 3$

$\frac{1}{\cancel{4}} \times \overset{3}{\cancel{12}} = 3$

$3 = 3$ (true)

The equation is true, so **12** is the solution.

OR

Use **inverse operations:**

- Consider the operation used to construct the division.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: Multiplication and division are inverse operations. Multiplying by $\frac{1}{4}$ (which is the same as dividing by 4) and then multiplying by 4 leaves a number unchanged.

Example: $\frac{1}{4} \times \boxed{?} = 3$

$\frac{1}{\cancel{4}} \times ? \times \cancel{4} = 3 \times 4$

$? = 12$

Q. $\frac{3}{5}$ of $\boxed{} = 21$

A. $\frac{3}{5}$ *of* $? = 21$ *OR* $\frac{3}{5}$ *of* $? = 21$

What number multiplied by $\frac{3}{5}$ gives 21?

$\frac{3}{\cancel{5}} \times \overset{6}{\cancel{30}} = 21$

Guess ? = 30

$18 = 21$ *(false)*

$\frac{3}{\cancel{5}} \times \overset{7}{\cancel{35}} = 21$

Guess ? = 35

$21 = 21$ *(true)*

The solution is ***35***.

$\frac{3}{5} \times ? = 21$

$\frac{3}{\cancel{5}} \times ? \times \cancel{5} = 21 \times 5$

$3 \times ? = 105$

$3 \times ? \div 3 = 105 \div 3$

$? = \mathbf{35}$

If the missing number has been divided by 5 and then multiplied by 3, then do the inverse operations and multiply by 5 and then divide by 3 both sides of the equation.

Use trial and error

a) $\frac{1}{6}$ of $\boxed{48} = 8$

Guess ? = 48

$\frac{1}{6} \times ? = 8$

$\frac{1}{\cancel{6}} \times \overset{8}{\cancel{48}} = 8 \Rightarrow 8 = 8$

$? = 48$

b) $\frac{1}{2}$ of $\boxed{} = 17$

$\frac{1}{2} \times ? = 17$

$\frac{1}{2} \times 34 = 17 \Rightarrow 17 = 17$

$? =$

c) $\frac{1}{7}$ of $\boxed{} = 9$

$\frac{1}{7} \times ? = 9$

$? =$

d) $\frac{1}{5} \times \boxed{} = 9$

$? =$

e) $\frac{1}{9} \times \boxed{} = 10$

$? =$

f) $\frac{1}{10} \times \boxed{} = 5$

$? =$

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Skill 22.3 Finding the missing number in equations involving fractions (2).

Operation: ÷ 8 — Use inverse operations

g) $\frac{1}{8} \times \boxed{64} = 8$

Inverse of ÷ 8 is × 8

$\frac{1}{8} \times ? \times 8 = 8 \times 8$

$? = 64$

h) $\frac{1}{4} \times \boxed{} = 48$

$? =$

i) $\frac{1}{3} \times \boxed{} = 60$

$? =$

j) $\frac{2}{3}$ of $\boxed{} = 10$

k) $\frac{3}{4}$ of $\boxed{} = 15$

l) $\frac{2}{5}$ of $\boxed{} = 12$

m) $\frac{4}{5} \times \boxed{} = 20$

n) $\frac{5}{6} \times \boxed{} = 50$

o) $\frac{2}{7} \times \boxed{} = 12$

p) $\frac{1}{3} \times \boxed{} = -21$

q) $\frac{1}{4} \times \boxed{} = -11$

r) $\frac{1}{5} \times \boxed{} = -12$

s) $\frac{1}{6} \times \boxed{} = -5$

t) $\frac{1}{8} \times \boxed{} = -7$

u) $\frac{1}{9} \times \boxed{} = -3$

continues on page 190

Skill 22.4 Finding the missing number in equations involving +, –, · and/or brackets (1).

EITHER

Use **trial and error:**

- Guess the value of the missing number that will make the equation true (both sides of the equation are equal).
- Substitute this value in the equation.
- Check if the equation is true.
- Write the guessed value as the solution of the equation.

Example:

$4 \times \boxed{?} - 13 = 15$ — *What number minus 13 gives 15?*

$4 \times ? = 28$

$4 \times 7 = 28$

$28 = 28$ (true)

The equation is true, so **7** is the solution.

OR

Use **inverse operations:**

- Consider the operation used to construct the equation.
- Get the missing number alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hints: For simplicity consider the equation inside the brackets, as one number.

Example:

$4 \times \boxed{?} - 13 = 15$

$4 \times ? - 13 + 13 = 15 + 13$

$4 \times ? \div 4 = 28 \div 4$

$? = 7$

Q. $4 \times (17 - \square) = 20$ **A.** $4 \times (17 - ?) = 20$ *What number multiplied by 4 gives 20?*

$17 - ? = 5$

$17 - 12 = 5$

$5 = 5$ (true) *Guess ? = 12*

The solution is ***12***.

OR $4 \times (17 - ?) \div 4 = 20 \div 4$

$17 - ? = 5$

$17 - ? - 17 = 5 - 17$

$-? = -12$

$? = 12$

If the bracket has been multiplied by 4, then do the inverse operation and divide by 4 both sides of the equation. Then subtract 17 from both sides. Finally reverse the signs.

Use trial and error

a) $8 + 4 \times \boxed{10} = 48$

$8 + 4 \times ? = 48$

$4 \times ? = 40$

$? = 10$

b) $5 + 6 \times \square = 47$

$5 + 6 \times ? = 47$

$6 \times ? = 42$

$? =$

c) $12 + 4 \times \square = 44$

$? =$

d) $4 \times (9 - \square) = 16$

$4 \times (9 - ?) = 16$

$9 - ? = 4$

$? =$

e) $3 \times (8 - \square) = 15$

$? =$

f) $7 \times (9 - \square) = 21$

$? =$

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Skill 22.4 Finding the missing number in equations involving +, –, · and/or brackets (2).

g) $15 + 6 \times \boxed{5} = 45$

Operation: + 15

Use inverse operations

Inverse of + 15 is – 15

15 + 6 × ? – 15 = 45 – 15

6 × ? ÷ 6 = 30 ÷ 6

? = 5

h) $16 + 2 \times \boxed{} = 40$

? =

i) $21 + 5 \times \boxed{} = 61$

? =

j) $8 \times (16 - \boxed{}) = 24$

k) $4 \times (13 - \boxed{}) = 16$

l) $8 \times (20 - \boxed{}) = 32$

m) $5 \times \boxed{} - 20 = 25$

n) $6 \times \boxed{} - 36 = 12$

o) $4 \times \boxed{} - 16 = 12$

p) $5 \times \boxed{} + 6 = 51$

q) $7 \times \boxed{} + 12 = 82$

r) $\boxed{} \times 7 + 8 = 50$

s) $36 - 6 \times \boxed{} = 12$

t) $50 - 7 \times \boxed{} = 15$

u) $42 - 10 \times \boxed{} = 22$

Skill 22.5 Finding the missing number in equations involving decimals.

- Use trial and error or inverse operation to find the missing number. (see skill 22.1, page 183 and skill 22.2, page 185)

Q. $\square + 2.7 = 3.4$ (What number added to 2.7 gives 3.4?) (Guess ? = 0.7)

A. $? + 2.7 = 3.4$ OR $? + 2.7 = 3.4$

$0.7 + 2.7 = 3.1$ $? + 2.7 - 2.7 = 3.4 - 2.7$

$3.4 = 3.4$ (true) $? = 0.7$

The solution is ***0.7***

If 2.7 was added to the missing number, then do the inverse operation and subtract 2.7 from both sides of the equation.

(Use trial and error)

a) $\boxed{4} \times 1.6 = 6.4$ (Guess ? = 4)

$? \times 1.6 = 6.4$

$? = 4$

b) $1.4 + \square = 2.6$

$1.4 + ? = 2.6$

$? =$

c) $2.8 + \square = 4.4$

$? =$

d) $3.8 - \square = 3$

$? =$

e) $2.9 - \square = 0.7$

$? =$

f) $\square \times 1.3 = 3.9$

$? =$

(Use inverse operations)

g) $4.2 - \boxed{1.5} = 2.7$ (Operation: + 4.2) (Inverse of + 4.2 is – 4.2)

$4.2 - ? - 4.2 = 2.7 - 4.2$

$-? = -1.5$

$? = 1.5$

h) $3.5 - \square = 1.2$

i) $2.8 - \square = 0.6$

j) $\square + 2.5 = 4$

k) $3.6 + \square = 5$

l) $\square + 1.2 = 2.1$

m) $1.2 \times \square = 7.2$

n) $1.7 \times \square = 3.4$

o) $1.4 \times \square = 7$

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Skill 22.6 Solving one-step equations by using the inverse operations of + and – (1).

- Consider the operation used to construct the sum or the difference involving the variable.
- Get the variable alone on one side of the equation, by performing the inverse operation to both sides of the equation.
- Evaluate the other side of the equation.

Hint: Remember that you must do the same operation to both sides of the equation.

Operation	Inverse Operation	Operation	Inverse Operation
+	–	–	+
$x + 3 = 6$ $x + 3 - 3 = 6 - 3$ $x = 3$		$x - 3 = 6$ $x - 3 + 3 = 6 + 3$ $x = 9$	

Q. Solve for p: $17 - p = 13$

A.
$+17 \quad -p = 13$ — Operation: + 17
$17 - p - 17 = 13 - 17$ — Simplify: 17 – 17 = 0; Inverse of + 17 is – 17
$-p = -4$ — Reverse sign both sides
$p = 4$

a) Solve for t: $t + 6 = 15$

Operation: + 6; Inverse of + 6 is – 6

$t + 6 - 6 = 15 - 6$

$t =$ 9

b) Solve for y: $y + 5 = 12$

$y + 5 - 5 = 12 - 5$

$y =$

c) Solve for r: $3 + r = 11$

$r =$

d) Solve for a: $a + 10 = 30$

$a =$

e) Solve for x: $8 + x = 17$

$x =$

f) Solve for m: $5 + m = 12$

$m =$

g) Solve for e: $e + 9 = 12$

$e =$

h) Solve for g: $g + 7 = 11$

$g =$

i) Solve for s: $13 + s = 22$

$s =$

j) Solve for t: $t - 3 = 6$

$t =$

k) Solve for y: $y - 4 = 9$

$y =$

l) Solve for z: $z - 5 = 2$

$z =$

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Skill 22.6 Solving one-step equations by using the inverse operations of + and – (2).

m) Solve for x: $x - 12 = 20$

$x =$ ☐

n) Solve for b: $b - 15 = 8$

$b =$ ☐

o) Solve for s: $s - 13 = 27$

$s =$ ☐

p) Solve for a: $14 - a = 6$

$14 - a - 14 = 6 - 14$

$-a = -8$

$a =$ 8

q) Solve for z: $24 - z = 10$

$z =$ ☐

r) Solve for s: $18 - s = 7$

$s =$ ☐

s) Solve for j: $10 - j = 2$

$j =$ ☐

t) Solve for c: $22 - c = 7$

$c =$ ☐

u) Solve for e: $16 - e = 9$

$e =$ ☐

v) Solve for d: $-3 + d = 9$

$d =$ ☐

w) Solve for v: $-6 + v = 12$

$v =$ ☐

x) Solve for n: $-8 + n = 7$

$n =$ ☐

y) Solve for h: $-9 + h = 12$

$h =$ ☐

z) Solve for k: $-7 + n = 25$

$k =$ ☐

zz) Solve for m: $-5 + m = 16$

$m =$ ☐

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Skill 22.7 Solving one-step equations by using the inverse operations of · and ÷ (1).

- Consider the operation used to construct the expression involving the variable.
- Get the variable alone on one side of the equation, by performing the inverse operation on both sides of the equation.
- Evaluate the other side of the equation.

Hint: Remember that you must do the same operation to both sides of the equation.

Operation ·	Inverse Operation ÷	Operation ÷	Inverse Operation ·
$3x = 6$ $\frac{3x}{3} = \frac{6}{3}$ $x = 2$		$\frac{x}{3} = 6$ $\frac{x}{3} \cdot 3 = 6 \cdot 3$ $x = 18$	

Q. Solve for x: $\frac{x}{8} = 6$

A. $\frac{x}{8} = 6$ (Operation: ÷ 8)

$\frac{x}{8} \cdot 8 = 6 \cdot 8$ (Inverse of ÷ 8 is × 8)

$\frac{x}{1} \cdot \frac{8}{1} = 6 \cdot 8$ (Simplify: 8 ÷ 8 = 1)

$x = 48$

a) Solve for a: $5 \cdot a = 45$ (Operation: · 5)

$\frac{5a}{5} = \frac{45}{5}$ (Inverse of · 5 is ÷ 5; Simplify: ÷ 5)

$a =$ 9

b) Solve for m: $4 \cdot m = 40$

$m =$

c) Solve for c: $6 \cdot c = 72$

$c =$

d) Solve for h: $7 \cdot h = 77$

$h =$

e) Solve for n: $9 \cdot n = 81$

$n =$

f) Solve for p: $8 \cdot p = 64$

$p =$

g) Solve for b: $8b = 24$

$b =$

h) Solve for z: $7z = 28$

$z =$

i) Solve for l: $9l = 54$

$l =$

j) Solve for r: $10r = 120$

$r =$

k) Solve for y: $5y = 75$

$y =$

l) Solve for u: $4u = 36$

$u =$

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Skill 22.7 Solving one-step equations by using the inverse operations of · and ÷ (2).

m) Solve for g: $15g = -30$

$15 \cdot g \div 15 = -30 \div 15$

$g =$ −2

n) Solve for a: $20a = -100$

$a =$

o) Solve for s: $3s = -21$

$s =$

p) Solve for d: $10d = -80$

$d =$

q) Solve for p: $12p = -36$

$p =$

r) Solve for h: $9h = -90$

$h =$

s) Solve for x: $\frac{x}{4} = 9$

Operation: ÷ 4

Inverse of ÷ 4 is · 4

$\frac{x}{4} \cdot 4 = 9 \cdot 4$

$x =$

t) Solve for c: $\frac{c}{5} = 6$

$c =$

u) Solve for q: $\frac{q}{3} = 8$

$q =$

v) Solve for n: $\frac{n}{7} = 3$

$n =$

w) Solve for r: $\frac{r}{8} = 12$

$r =$

x) Solve for j: $\frac{j}{4} = 15$

$j =$

y) Solve for b: $\frac{b}{6} = 12$

$b =$

z) Solve for e: $\frac{e}{9} = 10$

$e =$

zz) Solve for k: $\frac{k}{2} = 35$

$k =$

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Skill 22.8 Solving two-step equations by using the inverse operations of +, −, · and ÷ (1).

- Get the variable alone on one side of the equation, by performing the inverse operations, in order, to both sides of the equation. (see skill 22.6, page 192 and skill 22.7, page 194)
- Evaluate the other side of the equation.

Hint: Remember that you must do the same operation to both sides of the equation.

Q. Solve for v: $9v - 2 = -20$ **A.**

$9v - 2 = -20$ — Operation: -2

$9v - 2 + 2 = -20 + 2$ — Simplify: $-2 + 2 = 0$; Inverse of -2 is $+2$

$9v = -18$ — Operation: $\times 9$

$\frac{9v}{9} = -\frac{18}{9}$ — Simplify: $9 \div 9 = 1$; Inverse of $\times 9$ is $\div 9$

$v = -2$

a) Solve for x: $7x + 8 = 50$

Operation: $+8$; Inverse of $+8$ is -8

$7x + 8 - 8 = 50 - 8$

Inverse of $\cdot 7$ is $\div 7$

$7x = 42$

Simplify: $\div 7$

$\frac{7x}{7} = \frac{42}{7}$

$x =$ 6

b) Solve for y: $6y - 9 = 21$

$y =$

c) Solve for a: $3a + 8 = 29$

$a =$

d) Solve for d: $4d + 5 = 29$

$d =$

e) Solve for e: $3e - 5 = 25$

$e =$

f) Solve for u: $8u - 10 = 22$

$u =$

g) Solve for x: $2x - 26 = -2$

$x =$

h) Solve for t: $7t - 3 = -24$

$t =$

i) Solve for h: $5h - 6 = -6$

$h =$

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Skill 22.8 Solving two-step equations by using the inverse operations of +, −, · and ÷ (2).

j) Solve for i: $6i - 9 = -21$

$i =$ ☐

k) Solve for q: $5q - 7 = -32$

$q =$ ☐

l) Solve for s: $8s - 20 = -4$

$s =$ ☐

m) Solve for i: $4i + 12 = -20$

$i =$ ☐

n) Solve for j: $3j + 5 = -10$

$j =$ ☐

o) Solve for l: $10l + 4 = -26$

$l =$ ☐

p) Solve for x: $9x + 10 = 1$

$x =$ ☐

q) Solve for z: $4z + 19 = 3$

$z =$ ☐

r) Solve for c: $6c + 17 = 5$

$c =$ ☐

s) Solve for g: $7g + 8 = 1$

$g =$ ☐

t) Solve for m: $9m + 40 = 4$

$m =$ ☐

u) Solve for p: $2p + 18 = 6$

$p =$ ☐