14. [Expressions]

Skill 14.1 Writing expressions to represent word problems.

- Write the expression using the variables and/or the numbers mentioned in the word problem.
- Decide about the operation or operations needed in the expression.
  Example: $a + b$ (sum of a and b), $4n$ (product of 4 and n), $m - 20$ (20 less than m)
  Hint: *"Sum, all together, in total, more than"* ⇒ *addition* ⇒ +
  "Difference, less than, change" ⇒ *subtraction* ⇒ −
  "Product, times, lots of" ⇒ *multiplication* ⇒ ·
  "A fraction (half, third, quarter) of" ⇒ *division* ⇒ ÷

Q. Lisa earns a weekly wage of w dollars. How much money did she earn in a fortnight, if she received a $300 bonus?

A. *w dollars a week*
2 weeks in a fortnight } ⇒ *2 times w*
$300 bonus ⇒ +
⇒ ***2 · w + 300 or 2w + 300***

The · sign can be left out

a) Write as an expression:
The sum of d and 20.

sum ⇒ + ⇒ $d + 20$

b) Write as an expression:
The number seven times y.

⇒

c) Write as an expression:
The number 15 less than p.

⇒

d) Write as an expression:
Nine lots of s.

⇒

e) Write as an expression:
The product of −8 and t.

⇒

f) Write as an expression:
The sum of $2u$ and $3v$.

⇒

g) Lily had d dollars and spent a third of her money. How much money did she spend?

a third of ⇒ ÷ ⇒ $\frac{d}{3}$
or $d \div 3$

h) Out of the t tickets for sale, a quarter remained unsold. How many tickets remained unsold?

⇒

i) You pay $50 dollars at the gas station. How much change do you get if the gas was p dollars?

⇒

j) There are a local and b imported products at the supermarket. How many products are there all together?

⇒

k) Write as an expression:
Twice the product of p and q.

⇒

l) Write as an expression:
The number 6 less than the product of a and b.

⇒

Skill 14.2 Simplifying expressions by rearranging terms.

- Leave out the multiplication sign between letters or between letters and numbers.
  Example: $1 \cdot a = 1a = a$
- Write the number first, followed by the letters.
  Example: $m \cdot 3 = 3m$
- Write the letters in alphabetical order.
  Example: $c \cdot a \cdot b = abc$
- Replace the division sign with a fraction line.
  Example: $m \div n = \frac{m}{n}$
- Use the sign rules: $+ + = +$ $- - = +$ $+ - = -$ $- + = -$ (see skill 8.3, page 91)

Q. Rearrange $p \cdot 3 \cdot m$

A. $p \cdot 3 \cdot m =$ (The · signs can be left out)
$= 3mp$ (number first; alphabetical order)

a) Rearrange $j \cdot 5$ (number first; The · sign can be left out) $5j$

b) Rearrange $y \cdot 7$

c) Rearrange $n \cdot m \cdot o$

d) Rearrange $h \cdot g \cdot f$

e) Rearrange $6 \cdot z \cdot y$

f) Rearrange $4 \cdot u \cdot r$

g) Rearrange $3 \cdot x \div 2$ (÷ becomes fraction line; The · sign can be left out) $\frac{3x}{2}$

h) Rearrange $6 \cdot z \div 5$

i) Rearrange $4 \cdot b \cdot d \cdot c$

j) Rearrange $y \cdot 3 \cdot x \cdot z$

k) Rearrange $w \cdot (-z) \cdot 5 \cdot m$

l) Rearrange $c \cdot 8 \cdot d \cdot (-b)$

m) Rearrange $s \cdot r^2 \cdot 2$

n) Rearrange $j \cdot k^2 \cdot (-1)$

o) Rearrange $r \cdot 5 \cdot s \div t$

p) Rearrange $x \cdot 5 \cdot y \div (-z)$

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Skill 14.3 Finding like terms.

- Look at the combination of letters in all terms.

EITHER

- Find the **like terms**, terms that have the same combination of letters.

Example: $4c$ and $-c$
$-2x^2$ and $5x^2$ (like terms)
$-ab$, $5ba$ and $3ba$

OR

- Find the **unlike terms**, terms that do not have the same combination of letters.

Example: $2k$ and $2k^2$
$5uv$ and vw (unlike terms)
$3xy$, x and y

Hint: The order of the letters in a term does not matter.
$gh = hg$, $mn^2 = n^2m$

Q. Choose the like terms:
a^2b, $-ab$, $4ba$

A. *$4ba = 4ab$*
$-ab$ and $4ab$ have the same combination of letters (ab)
*$\Rightarrow$ **$-ab$** and **$4ba$** are like terms.*

a) Choose the like terms:
$8a$, 3, $5a$ (like terms)
$8a$, $5a$

b) Choose the like terms:
-2, $-2m$, $3m$

c) Choose the like terms:
m^2, $3m^2$, $3m$ (unlike terms)

d) Choose the like terms:
t^2, $2t$, $-t^2$

e) Choose the like terms:
$3cd$, dc, $3c$
$3cd$, dc

f) Choose the like terms:
$-bc$, $5c$, $5cb$

g) Choose the like terms:
$3t^2$, $-2t$, 4, $3t$

h) Choose the like terms:
$-6w$, 8, w^2, w

i) Choose the like terms:
$3s$, $2.3s$, s^2, 2.3

j) Choose the like terms:
$-0.2y$, $-0.2y^2$, $2y$, 2.2

k) Choose the like terms:
v^2, $-2v$, u^2, $-2v^2$

l) Choose the like terms:
$4k$, $4k^2$, l^2, $-k^2$

m) Choose the like terms:
z^2, $8z$, $-8z^2$, z^3

n) Choose the like terms:
g, g^2, $-4g^2$, g^3

o) Choose the like terms:
$-xy$, x^2y, $2yx^2$, $2xy^2$

p) Choose the like terms:
a^2b, $2ab$, $2ba^2$, $-ab^2$

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Skill 14.4 Simplifying expressions by adding and subtracting like terms.

- Group like terms. (see skill 14.3, page 161)
- Read the sign in front of each term.
- Add and/or subtract only the like terms.
- Add and/or subtract the coefficients first, then copy the letter combination.
  Example: $3g + 5g = (3 + 5)g = 8g$
  (coefficients)
- Write coefficient 1 in front of any pronumeral.
  Example: $a = 1a$, $-b = -1b$, $c^2 = 1c^2$

Hint: Unlike terms cannot be added or subtracted.

Q. Simplify $3x^2 - 6x + x^2 + 7x$

A. $3x^2 - 6x + x^2 + 7x =$ (group like terms; $x^2 = 1x^2$)
$= 3x^2 + 1x^2 - 6x + 7x$ ($3 + 1 = 4$; $-6 + 7 = 1$)
$= 4x^2 + 1x$
$= \mathbf{4x^2 + x}$

a) Simplify $2m + m$

$= 2m + 1m$ $=$ 3m

b) Simplify $5cd + dc$

$= 5cd + 1cd$ $=$

c) Simplify $4j - 3j + 2j$

$=$ $=$

d) Simplify $7xy - 5xy + xy$

$=$ $=$

e) Simplify $5a + 3b - 2a$ (group like terms)

$= 5a - 2a + 3b$ $=$

f) Simplify $t^2 + 3t + 2t^2$

$=$ $=$

g) Simplify $6ad + 2d - 5da + 3d$ (group like terms)

$= 6ad - 5ad + 2d + 3d$ $=$

h) Simplify $3m + 5n - 4m - n$

$=$ $=$

i) Simplify $4p^2 - p^2 - 3p + 2p^2$

$=$ $=$

j) Simplify $3y^2 - 2yz - y^2 + 3zy$

$=$ $=$

k) Simplify $2r^2 + s^2 + r^2 - 4s^2$

$=$ $=$

l) Simplify $-3x - x^2 + x + 4x^2$

$=$ $=$

m) Simplify $3d - d^2e - 2ed^2 - 4d$

$=$ $=$

n) Simplify $3ab^2 - 2ab^2 - 4a^2b + a^2b$

$=$ $=$

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Skill 14.5 Simplifying expressions by multiplying terms.

- Read the sign in front of each term.
- Multiply the coefficients.
- Multiply the letters.
- Use the sign rules: $+ + = +$ $- - = +$ $+ - = -$ $- + = -$ (see skill 8.3, page 91)
  Example: $2u \cdot -3v = 2 \cdot (-3) \cdot (u \cdot v) = -6 \cdot uv = -6uv$
  (coefficients; $+ - = -$)
- Write coefficient 1 in front of any letter.
  Example: $a = 1a$, $-b = -1b$, $c^2 = 1c^2$
  Hint: Any terms can be multiplied.

Q. Simplify $(-3cd) \cdot 4c \cdot (-d)$ (multiply the coefficients)

A. $(-3cd) \cdot 4c \cdot (-d) =$ (multiply the letters)
$= -3 \cdot 4 \cdot (-1) \cdot cd \cdot c \cdot d =$ ($- - = +$)
$= -12 \cdot (-1) \cdot c^2d \cdot d =$
$= 12 \cdot c^2d^2$
$= \mathbf{12c^2d^2}$

a) Simplify $4 \cdot 3v$

$= 4 \cdot 3 \cdot v$ (multiply the coefficients) $=$ $12v$

b) Simplify $3xy \cdot 5$

$=$ ..... $=$ .....

c) Simplify $2m \cdot 7n$

$=$ ..... $=$ .....

d) Simplify $(-8j) \cdot 5k$

$=$ ..... $=$ .....

e) Simplify $(-4d) \cdot (-5e)$

$=$ ..... $=$ .....

f) Simplify $3b \cdot 6b$

$=$ ..... $=$ .....

g) Simplify $(-10xz) \cdot 3z$

$=$ ..... $=$ .....

h) Simplify $(-4gh) \cdot 5g$

$=$ ..... $=$ .....

i) Simplify $2s \cdot (-5t) \cdot 3s$

$= 2 \cdot (-5) \cdot 3 \cdot s \cdot t \cdot s$

$= -10 \cdot 3 \cdot st \cdot s$ $=$ $-30s^2t$

j) Simplify $(-4p) \cdot 2q \cdot 3p$

$=$ .....

$=$ ..... $=$ .....

k) Simplify $3jk \cdot (-5k) \cdot (-j)$

$=$ .....

$=$ ..... $=$ .....

l) Simplify $(-bc) \cdot (-5c) \cdot 5c$

$=$ .....

$=$ ..... $=$ .....

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Skill 14.6 Simplifying expressions by dividing terms.

- Read the sign in front of each term.
- Write the division as a fraction.
- Simplify by dividing the coefficients.
- Simplify by dividing the letters.
- Use the sign rules: $+ \div + = +$ $- \div - = +$ $+ \div - = -$ $- \div + = -$ (see skill 8.3, page 91)
- Write coefficient 1 in front of any letter.
  Example: $a = 1a$, $-b = -1b$, $c^2 = 1c^2$

Q. Simplify $(-30x^2y) \div (3y)$

A. $(-30x^2y) \div (3y) =$

$= -\dfrac{\overset{10}{\cancel{30}}x^2\cancel{y}}{\underset{1}{\cancel{3}}\cancel{y}}$ Simplify: ÷ 3

$= -\dfrac{10x^2\overset{1}{\cancel{y}}}{\underset{1}{\cancel{y}}}$ Simplify: ÷ y

$= \boldsymbol{-10x^2}$

a) Simplify $12y \div 3$

$= \dfrac{\overset{4}{\cancel{12}}y}{\underset{1}{\cancel{3}}}$ $= 4y$

b) Simplify $24pq \div 4$

$= \dfrac{\overset{6}{\cancel{24}}pq}{\underset{1}{\cancel{4}}}$ $=$

c) Simplify $(14a) \div (2a)$ $a \div a = 1$

$=$ $=$

d) Simplify $(-35mn) \div (-5n)$ $- \div - = +$

$=$ $=$

e) Simplify $(-15z^2) \div (3z)$ $- \div + = -$

$=$ $z^2 \div z = z$ $=$

f) Simplify $(-12xy) \div (2y)$

$=$ $=$

g) Simplify $(18x) \div (15x)$

$=$ $=$

h) Simplify $(20cd) \div (cd)$

$=$ $=$

i) Simplify $(11ab) \div (-11b)$

$=$ $=$

j) Simplify $(-25c^2d) \div (5c)$

$= -\dfrac{\overset{5}{\cancel{25}}c^2\overset{1}{\cancel{d}}}{\underset{1}{\cancel{5}}\underset{1}{\cancel{d}}}$ Simplify: ÷ 4 then ÷ d $=$ $-5c^2$

k) Simplify $(20xy) \div (4x) \cdot xz$

$= \dfrac{\overset{5}{\cancel{20}}\overset{1}{\cancel{x}}y}{\underset{1}{\cancel{4}}\cancel{x}} \cdot xz = 5y \cdot xz$ $=$

l) Simplify $(27gh) \div (9g) \cdot gi$

$=$ $=$

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