22. [Algebra - Substitution]

Skill 22.1 Substituting into expressions involving + and –

MM7 11 22 33 44
MM8 11 22 33 44

Substituting into an expression means replacing the letters (pronumerals) with numbers and follow the order of operations.

Q. If $x = 3$, find the value of: $x + 4$

A. $x + 4$
$= 3 + 4$
$= 7$

Substitute x with 3.
Add 3 and 4.

Q. If $m = 6$ and $n = 2$, find the value of: $m - n + m + 4$

A. $m - n + m + 4$
$= 6 - 2 + 6 + 4$
$= 4 + 6 + 4$
$= \mathbf{14}$

Substitute m with 6 and n with 2.
Working from left to right, take 2 from 6.
Add 4 and 6 and 4.

a) If $t = 7$, find the value of: $t + 5$

$= 7 + 5$

$= 12$

b) If $r = 8$, find the value of: $r + 3$

$=$

$=$

c) If $p = 5$, find the value of: $p + 4$

$=$

$=$

d) If $a = 6$, find the value of: $a + a + 4$

$=$

$=$

$=$

e) If $h = 3$, find the value of: $h + h + h + 9$

$=$

$=$

$=$

f) If $k = 6$, find the value of: $k + k + 9 - k$

$= 6 + 6 + 9 - 6$

$= 21 - 6$

$=$

g) If $f = 15$ and $g = 4$, find the value of: $f - g$

$=$

$=$

h) If $l = 8$ and $m = 5$, find the value of: $m + l$

$=$

$=$

i) If $q = 42$ and $r = 27$, find the value of: $q - r$

$=$

$=$

j) If $s = 9$ and $t = 2$, find the value of: $s - t + s + 4$

$=$

$=$

$=$

k) If $y = 8$ and $z = 5$, find the value of: $12 - y + 7 - z$

$=$

$=$

$=$

l) If $a = 6$ and $b = 3$, find the value of: $9 + a + a - b$

$=$

$=$

$=$

Skill 22.2 Substituting into expressions involving ×

Q. If $y = 4$, find the value of: $3 \times y$

A. $3 \times y$
$= 3 \times 4$
$= \mathbf{12}$

Substitute y with 4.
Multiply 3 by 4.

Q. If $s = 2$ and $t = 3$, find the value of: $s \times t \times 4$

A. $s \times t \times 4$
$= 2 \times 3 \times 4$
$= 6 \times 4$
$= \mathbf{24}$

Substitute s with 2 and t with 3.
Working from left to right, multiply 2 by 3.
Then multiply 6 by 4.

a) If $t = 8$, find the value of: $2 \times t$

$= 2 \times 8$

$= 16$

b) If $h = 7$, find the value of: $3 \times h$

$=$ .....

$=$ .....

c) If $d = 6$, find the value of: $d \times d$

$=$ .....

$=$ .....

d) If $a = 5$, find the value of: $a \times a \times 4$

$=$ .....

$=$ .....

$=$ .....

e) If $w = 3$ and $x = 4$, find the value of: $2 \times w \times x$

$=$ .....

$=$ .....

$=$ .....

f) If $j = 3$ and $k = 7$, find the value of: $3 \times j \times k$

$=$ .....

$=$ .....

$=$ .....

g) If $y = 10$, find the value of: $y \times y \times y$

$=$ .....

$=$ .....

$=$ .....

h) If $s = 2$ and $t = 8$, find the value of: $s \times t \times 1$

$=$ .....

$=$ .....

$=$ .....

i) If $m = 4$ and $n = 6$, find the value of: $5 \times m \times n$

$=$ .....

$=$ .....

$=$ .....

Skill 22.3 Substituting into various expressions.

Q. If $c = 4$, find the value of: $3c + 1$

A. $3c + 1$
$= 3 \times c + 1$
$= 3 \times 4 + 1$
$= 12 + 1$
$= \mathbf{13}$

Expand 3c to $3 \times c$.
Substitute c with 4.
Multiply 3 by 4.
Add 12 and 1.

Q. If $a = 4$ and $b = 6$, find the value of: $2ab$

A. $2ab$
$= 2 \times a \times b$
$= 2 \times 4 \times 6$
$= 8 \times 6$
$= \mathbf{48}$

2ab is the short expression for $2 \times a \times b$
Substitute a with 4 and b with 6.
Working from left to right, multiply 2 by 4.
Then multiply 8 by 6.

a) If $a = 4$, find the value of: $4a$

$= 4 \times a$
$= 4 \times 4$
$= 16$

b) If $m = 3$, find the value of: $2m$

c) If $j = 7$, find the value of: $5j$

d) If $h = 3$, find the value of: $4h - 10$

$= 4 \times h - 10$
$= 4 \times 3 - 10$
$= 12 - 10$
$= 2$

e) If $p = 4$, find the value of: $2p + 5$

f) If $k = 7$, find the value of: $3k - 12$

g) If $t = 3$ and $u = 2$, find the value of: $2tu$

$= 2 \times t \times u$
$= 2 \times 3 \times 2$
$= 6 \times 2$
$= 12$

h) If $y = 5$ and $z = 4$, find the value of: $2yz$

i) If $q = 3$ and $r = 7$, find the value of: $3qr$

Skill 22.4 Substituting into expressions involving fractions.

Q. If $d = 8$, find the value of: $\frac{1}{2}$ of d

A. $\frac{1}{2}$ *of* d
$= \frac{1}{2} \times 8$
$= \frac{8}{2}$
$= 4$

Substitute d with 8.
Replace "of" with "×".
Multiply 1 by 8.
To simplify the fraction divide the numerator by the denominator:
$8 \div 2 = 4$

Q. If $a = 6$, find the value of: $\frac{18}{a}$

A. $\frac{18}{a}$
$= \frac{18^{\div 6}}{6_{\div 6}}$
$= \frac{3}{1}$
$= 3$

Substitute a with 6.
To simplify the fraction divide the numerator and the denominator by their HCF, which is 6.

a) If $b = 6$, find the value of: $\frac{1}{3}$ of b

$= \frac{1}{3} \times 6$
$= \frac{6}{3}$
$= 2$

b) If $c = 12$, find the value of: $\frac{1}{4}$ of c

c) If $p = 10$, find the value of: $\frac{1}{2}$ of p

d) If $r = 24$, find the value of: $\frac{1}{6}$ of r

e) If $h = 15$, find the value of: $\frac{2}{3}$ of h

f) If $m = 12$, find the value of: $\frac{3}{4}$ of m

g) If $g = 15$, find the value of: $\frac{g}{5}$

$= \frac{15}{5}$
$= 3$

h) If $x = 9$, find the value of: $\frac{x}{3}$

i) If $k = 8$, find the value of: $\frac{24}{k}$

Skill 22.5 Substituting into expressions involving +, –, ( ) and ×

Q. If $g = 2$ and $h = 3$, find the value of: $4g + 3h$

A. $4g + 3h$
$= 4 \times 2 + 3 \times 3$
$= 8 + 9$
$= \mathbf{17}$

Substitute g with 2 and h with 3. Use the order of operations rules. First multiply 4 by 2, then 3 by 3. Finally add 8 and 9.

Q. If $x = 2$, find the value of: $4(x + 5)$

A. $4(x + 5)$
$= 4 \times (2 + 5)$
$= 4 \times 7$
$= \mathbf{28}$

Substitute x with 2. Use the order of operations rules. First add 2 and 5 within the brackets. Then multiply 4 by 7.

a) If $l = 4$ and $m = 7$, find the value of: $3l + 2m$

$= 3 \times l + 2 \times m$
$= 3 \times 4 + 2 \times 7$
$= 12 + 14$
$= 26$

b) If $s = 5$ and $t = 3$, find the value of: $4s - 2t$

c) If $h = 2$ and $i = 8$, find the value of: $5h + 3i$

d) If $w = 4$, find the value of: $3(w + 2)$

$= 3 \times (4 + 2)$
$= 3 \times 6$
$= 18$

e) If $s = 9$, find the value of: $8(s - 2)$

f) If $j = 7$, find the value of: $4(5 + j)$

g) If $a = 6$, find the value of: $7(a + 8)$

h) If $z = 10$, find the value of: $4(z - 4)$

i) If $d = 12$, find the value of: $5(d - 7)$

Skill 22.6 Substituting into expressions involving squared terms.

Q. If $f = 3$, find the value of: $4f^2$

A. $4f^2$
$= 4 \times f \times f$
$= 4 \times 3 \times 3$
$= 12 \times 3$
$= \mathbf{36}$

Expand f^2 to become $f \times f$.
Substitute f with 3.
Use the order of operations rules.
First multiply 4 by 3.
Then multiply 12 by 3.

a) If $s = 9$, find the value of: s^2

$= 9 \times 9$

$= 81$

$=$ .....

b) If $w = 2$, find the value of: $5w^2$

$= 5 \times 2 \times 2$

$= 10 \times 2$

$= 20$

c) If $a = 5$, find the value of: $3a^2$

$=$ .....

$=$ .....

$=$ .....

d) If $b = 4$, find the value of: $5b^2$

$=$ .....

$=$ .....

$=$ .....

e) If $z = 20$, find the value of: $3z^2$

$=$ .....

$=$ .....

$=$ .....

f) If $t = 5$, find the value of: $8t^2$

$=$ .....

$=$ .....

$=$ .....

g) If $g = 7$, find the value of: $10g^2$

$=$ .....

$=$ .....

$=$ .....

h) If $v = 5$, find the value of: $5v^2$

$=$ .....

$=$ .....

$=$ .....

i) If $m = 1$, find the value of: $4m^2$

$=$ .....

$=$ .....

$=$ .....

j) If $x = 10$, find the value of: $20x^2$

$=$ .....

$=$ .....

$=$ .....

k) If $t = 12$, find the value of: $2t^2$

$=$ .....

$=$ .....

$=$ .....

l) If $y = 8$, find the value of: $3y^2$

$=$ .....

$=$ .....

$=$ .....