



Substitution

Mana Maths

Te reo Māori terms



taurangi

variable

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kīanga

expression

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whakakapi

substitute / replace

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aromatawai

evaluate / assess

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Notes & Steps



Key idea

Substitution means replacing a variable with its value, then simplifying carefully. If $x = 3$, then every x is replaced by 3.

Steps

1. Write the value of the variable clearly.
2. Replace each variable with that value.
3. Use brackets if needed, especially with negatives.
4. Work out the expression using GEMA.

Common mistake

Forgetting brackets with negatives. If $x = -3$, then $x^2 = (-3)^2 = 9$, not -9 .

Key facts

- ▶ If $x = 4$, then $2x = 8$.
- ▶ If $a = 5$, then $a^2 = 25$.
- ▶ If $p = 3$ and $q = 2$, then $p + 2q = 7$.
- ▶ Brackets matter: if $x = -2$, then $x^2 = 4$ but $-x^2 = -4$.

Try these

1. If $x = 3$, find $x + 4$.
2. If $a = 5$, find $2a$.
3. If $m = 2$, $n = 4$, find $m + n$.

Notes & Steps



Example 1: one variable

If $x = 4$, find $2x + 3$.

$$2x + 3 = 2(4) + 3 = 8 + 3 = 11$$

Example 2: two variables

If $p = 5$ and $q = 2$, find $p + 2q$.

$$p + 2q = 5 + 2(2) = 5 + 4 = 9$$

Example 3: powers

If $a = 3$, find $a^2 + 1$.

$$a^2 + 1 = 3^2 + 1 = 9 + 1 = 10$$

Example 4: negative value

If $x = -2$, find $x^2 + 3$.

$$x^2 + 3 = (-2)^2 + 3 = 4 + 3 = 7$$

Start Tasks



1. Evaluate when $x = 3$:
 $x + 4$.

2. Evaluate when
 $x = 5$: $x - 2$.

3. Evaluate when
 $x = 4$: $2x$.

4. Evaluate when
 $x = 6$: $x + 7$.

5. Evaluate when
 $y = 2$: $3y$.

6. Evaluate when
 $a = 8$: $a - 5$.

7. Evaluate when
 $m = 1$: $m + 9$.

8. Evaluate when
 $p = 5$: $2p + 1$.

9. Evaluate when $t = 4$:
 t^2 .

Start Tasks — Answers



1. $x + 4, x = 3$

$$3 + 4 = 7$$

2. $x - 2, x = 5$

$$5 - 2 = 3$$

3. $2x, x = 4$

$$2 \times 4 = 8$$

4. $x + 7, x = 6$

$$6 + 7 = 13$$

5. $3y, y = 2$

$$3 \times 2 = 6$$

6. $a - 5, a = 8$

$$8 - 5 = 3$$

7. $m + 9, m = 1$

$$1 + 9 = 10$$

8. $2p + 1, p = 5$

$$2 \times 5 + 1 = 11$$

9. $t^2, t = 4$

$$4^2 = 16$$

Start Tasks



10. Given $p = 5$ and $q = 2$, find $p + q$.

11. Given $p = 5$ and $q = 2$, find $p - q$.

12. Given $p = 5$ and $q = 2$, find $p + 2q$.

13. Given $a = 3$, find $4a - 1$.

14. Given $b = 7$, find $b + 6$.

15. Given $n = 9$, find $n \div 3$.

16. Given $k = 4$, find $3k - 2$.

17. Given $r = 10$, find $r - 7$.

18. Given $c = 2$, find $c^2 + 3$.

Start Tasks — Answers



10. $p + q, p = 5, q = 2$
 $5 + 2 = 7$

11. $p - q, p = 5, q = 2$
 $5 - 2 = 3$

12. $p + 2q, p = 5, q = 2$
 $5 + 2 \times 2 = 9$

13. $4a - 1, a = 3$
 $4 \times 3 - 1 = 11$

14. $b + 6, b = 7$
 $7 + 6 = 13$

15. $n \div 3, n = 9$
 $9 \div 3 = 3$

16. $3k - 2, k = 4$
 $3 \times 4 - 2 = 10$

17. $r - 7, r = 10$
 $10 - 7 = 3$

18. $c^2 + 3, c = 2$
 $2^2 + 3 = 7$

Start Tasks



19. Is $x = 3$ a solution to $x + 2 = 5$?

20. Is $y = 4$ a solution to $2y = 8$?

21. Is $m = 1$ a solution to $m + 6 = 10$?

22. Evaluate when $x = 2$: $(x + 3)$.

23. Evaluate when $x = 4$: $(2x + 5)$.

24. Evaluate when $p = 3$ and $q = 6$: $q - p$.

25. Evaluate when $a = 5$: $2a^2$.

26. Evaluate when $d = 12$: $d \div 4 + 1$.

27. Evaluate when $x = 7$: $x + 2x$.

Start Tasks — Answers



19. $x + 2 = 5, x = 3$

$3 + 2 = 5 \checkmark$

22. $x + 3, x = 2$

$2 + 3 = 5$

25. $2a^2, a = 5$

$2 \times 5^2 = 50$

20. $2y = 8, y = 4$

$2 \times 4 = 8 \checkmark$

23. $2x + 5, x = 4$

$2 \times 4 + 5 = 13$

26. $d \div 4 + 1, d = 12$

$12 \div 4 + 1 = 4$

21. $m + 6 = 10, m = 1$

$1 + 6 = 7 \neq 10 \times$

24. $q - p, p = 3, q = 6$

$6 - 3 = 3$

27. $x + 2x, x = 7$

$7 + 2 \times 7 = 21$

Build Tasks



1. Given $x = 3$, $y = 4$,
find $x + y$.

2. Given $x = 3$, $y = 4$,
find $2x + 3y$.

3. Given $x = 3$, $y = 4$,
find xy .

4. Given $x = 3$, $y = 4$,
find $x^2 + y$.

5. Given $x = 3$, $y = 4$,
find $3x - 2y$.

6. Given $a = 5$, find
 $3a + 2$.

7. Given $a = 5$, find $2a^2$.

8. Given $a = 5$, find
 $2(a + 3)$.

9. Given $a = 5$, find
 $a^2 + 1$.

Build Tasks — Answers



1. $2x, x = 3$

$$2 \times 3 = 6$$

4. $x^2, x = 3$

$$3^2 = 9$$

7. $a + 12, a = 5$

$$5 + 12 = 17$$

2. $x + 7, x = 3$

$$3 + 7 = 10$$

5. $x^2 + 4, x = 3$

$$3^2 + 4 = 13$$

8. $4a - 3, a = 5$

$$4 \times 5 - 3 = 17$$

3. $5x - 2, x = 3$

$$5 \times 3 - 2 = 13$$

6. $3a, a = 5$

$$3 \times 5 = 15$$

9. $a^2 - 2, a = 5$

$$5^2 - 2 = 23$$

Build Tasks



10. Given $m = 2$, $n = 5$,
find $3m + n^2$.

11. Given $m = 2$, $n = 5$,
find $2mn$.

12. Given $m = 2$, $n = 5$,
find $3(m + n)$.

13. Given $p = 6$, $q = 3$,
find $p \div q$.

14. Given $p = 6$, $q = 3$,
find $2p - q$.

15. Given $u = 4$, $v = 2$,
find $u^2 - v$.

16. Given $u = 4$, $v = 2$,
find $(u + v)^2$.

17. Given $x = 8$, $y = 2$,
find $x \div y + 5$.

18. Given $x = 8$, $y = 2$,
find $(x - y) \times 2$.

Build Tasks — Answers



10. $5m, m = 2$

$$5 \times 2 = 10$$

13. $p \div 2, p = 6$

$$6 \div 2 = 3$$

16. $u^2 + 5, u = 4$

$$4^2 + 5 = 21$$

11. $3m + 8, m = 2$

$$3 \times 2 + 8 = 14$$

14. $p^2, p = 6$

$$6^2 = 36$$

17. $2x + 3, x = 8$

$$2 \times 8 + 3 = 19$$

12. $m^2 + 1, m = 2$

$$2^2 + 1 = 5$$

15. $4u - 3, u = 4$

$$4 \times 4 - 3 = 13$$

18. $x^2 - 10, x = 8$

$$8^2 - 10 = 54$$

Build Tasks



19. Given $a = 7$, $b = 1$,
find $a^2 - b^2$.

20. Given $a = 7$, $b = 1$,
find $(a + b) \div 2$.

21. Given $k = 3$, $h = 9$,
find $h - 2k$.

22. Given $k = 3$, $h = 9$,
find $hk \div 3$.

23. Given $r = 5$, $s = 4$,
find $2r + s^2$.

24. Given $r = 5$, $s = 4$,
find $(r - s)^2$.

25. Given $x = 2$, $y = 10$,
find $y \div x + x$.

26. Given $x = 2$, $y = 10$,
find $3x + y \div 2$.

27. Given $m = 4$, $n = 3$,
find $m^2 + 2n$.

Build Tasks — Answers



19. $2a + 5, a = 7$

$$2 \times 7 + 5 = 19$$

20. $a^2 - 3, a = 7$

$$7^2 - 3 = 46$$

21. $5k - 2, k = 3$

$$5 \times 3 - 2 = 13$$

22. $k^2 + 4, k = 3$

$$3^2 + 4 = 13$$

23. $3r + 7, r = 5$

$$3 \times 5 + 7 = 22$$

24. $r^2 - 6, r = 5$

$$5^2 - 6 = 19$$

25. $4x - 3, x = 2$

$$4 \times 2 - 3 = 5$$

26. $2x^2, x = 2$

$$2 \times 2^2 = 8$$

27. $3m + 1, m = 4$

$$3 \times 4 + 1 = 13$$

Push Tasks



1. Given $x = 3$, $y = -2$,
find $x^2 + 2y$.

2. Given $x = 3$, $y = -2$,
find $(x + y)^2$.

3. Given $x = 3$, $y = -2$,
find $x^3 - y$.

4. Given $x = 3$, $y = -2$,
find $2x^2 - 3y$.

5. Given $a = 4$, $b = 0.5$,
find $2ab^2$.

6. Given $a = 4$, $b = 0.5$,
find a^2b .

7. Given $a = 4$, $b = 0.5$,
find $(a + b)^2$.

8. Given $m = -1$,
 $n = 6$, find $m^2 + n$.

9. Given $m = -1$,
 $n = 6$, find $3m + n \div 2$.

Push Tasks — Answers



1. $2x + 5, x = 3$

$$2 \times 3 + 5 = 11$$

2. $x^2 - 4, x = 3$

$$3^2 - 4 = 5$$

3. $3x^2, x = 3$

$$3 \times 3^2 = 27$$

4. $(x + 2)^2, x = 3$

$$(3 + 2)^2 = 25$$

5. $2a + 3, a = 4$

$$2 \times 4 + 3 = 11$$

6. $a^2 - 1, a = 4$

$$4^2 - 1 = 15$$

7. $3a^2, a = 4$

$$3 \times 4^2 = 48$$

8. $3m + 2, m = -1$

$$3(-1) + 2 = -1$$

9. $m^2, m = -1$

$$(-1)^2 = 1$$

Push Tasks



10. Given $p = 2$,
 $q = -3$, find $(p - q)^2$.

11. Given $p = 2$,
 $q = -3$, find $p^2 + q^2$.

12. Given $u = 1.5$,
 $v = 2$, find $uv + u$.

13. Given $u = 1.5$,
 $v = 2$, find $(u + v) \div v$.

14. A rectangle has
length $x + 2$ and width
 $x - 1$. Find area when
 $x = 5$.

15. A square has side
 $a + 1$. Find perimeter
when $a = 4$.

16. A taxi fare is $3n + 4$
dollars. Find it when
 $n = 6$.

17. The rule is $2t^2 - 1$.
Find the value when
 $t = 3$.

18. The rule is $5 - h^2$.
Find the value when
 $h = -2$.

Push Tasks — Answers



10. $4p - 3, p = 2$
 $4 \times 2 - 3 = 5$

13. $u^2 + 1, u = 1.5$
 $1.5^2 + 1 = 3.25$

16. Taxi $3n + 4, n = 5$
 $3 \times 5 + 4 = 19$ **dollars**

11. $2p^2, p = 2$
 $2 \times 2^2 = 8$

14. Rectangle $x + 2$ by
 $3, x = 4$
 $(4 + 2) \times 3 = 18$

17. Rule $2t^2 - 1, t = 3$
 $2 \times 3^2 - 1 = 17$

12. $5u - 2, u = 1.5$
 $5 \times 1.5 - 2 = 5.5$

15. Square $(a + 1)^2,$
 $a = 3$
 $(3 + 1)^2 = 16$

18. Rule $5 - h^2, h = 2$
 $5 - 2^2 = 1$

Push Tasks



19. If $x = 4$, find $2(x + 3)^2$.

20. If $x = 4$, find $(2x - 5)(x - 1)$.

21. If $y = -1$, find $3y^2 + 2y$.

22. If $a = 2$, $b = 3$, find $a^2 + b^2 + ab$.

23. If $a = 2$, $b = 3$, find $(a + b)^3$.

24. If $r = 10$, find πr^2 using $\pi = 3.14$.

25. If $c = 20$, find $(c - 8) \div 4 + 3$.

26. A triangle has base $b = 8$ and height $h = 5$. Find $\frac{1}{2}bh$.

27. Check whether $x = 2$ makes $x^2 + 3x = 10$ true.

Push Tasks — Answers



19. $3x - 2, x = 4$

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

20. $x^2 + 1, x = 4$

$$4^2 + 1 = 17$$

21. $2y + 5, y = -1$

$$2(-1) + 5 = 3$$

22. $a^2 - 3a, a = 2$

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

23. $4a + 1, a = 2$

$$4 \times 2 + 1 = 9$$

24. $r^2 \div 5, r = 10$

$$10^2 \div 5 = 20$$

25. $c \div 4 - 3, c = 20$

$$20 \div 4 - 3 = 2$$

26. Triangle $\frac{1}{2}bh,$

$$b = 8, h = 5$$

$$\frac{1}{2} \times 8 \times 5 = 20$$

27. $3x + 1 = 7, x = 2$

$$3 \times 2 + 1 = 7 \checkmark$$