

Unit 3 - Factoring

WORKBOOK

MPM2D

$$\begin{aligned} & 3x^2 - 5x - 2 \quad \underline{-6} + \underline{1} = -5 \\ & = 3x^2 - 6x + 1x - 2 \quad \underline{-6} \times \underline{1} = 3(-2) = -6 \\ & = (3x^2 - 6x) + (x - 2) \\ & = 3x(x - 2) + 1(x - 2) \quad \text{Common factor} \\ & \quad \quad \quad \text{the common binomial} \\ & = (x - 2)(3x + 1) \end{aligned}$$

W1 – Multiplying Binomials

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*Jensen***1) Simplify the following expressions**

a) $(3x + 4) + (5x + 2)$

b) $(2 - 3yz) + (7 + 6yz)$

c) $(5x + 7) - (2x - 1)$

2) Multiply

a) $(4x)(7x^2)$

b) $(-6m^2n^3)(-7mn^2)$

c) $(2xy)(-3x^2y^3)(-3x^2)$

3) Expand and simplify

a) $2(x - 4) + 5(x + 3)$

b) $4(2x - 7) - 5(4x + 9)$

c) $4x + 3(2x - 5) + 6(1 - 5x)$

4) Expand and simplify

a) $(x + 1)(x + 5)$

b) $(x - 4)(x - 3)$

c) $(c + 2)(c - 8)$

$$\mathbf{d)} (a - 3)(2a - 5)$$

$$\mathbf{e)} (x - 5)(4x + 3)$$

$$\mathbf{f)} (3a - 5)(3a + 5)$$

$$\mathbf{g)} 2(x + 3)(x + 5)$$

$$\mathbf{h)} -2(4y + 1)(y - 3)$$

$$\mathbf{i)} (3x + y)(x + 4y)$$

$$\mathbf{j)} (-3a + 4b)(2a + 3b)$$

$$\mathbf{k)} (x + 6)(x + 4) + (x + 2)(x + 3)$$

$$\mathbf{l)} 2(3x + 2)(3x + 2) - 3(2x - 1)(x + 4)$$

$$\mathbf{m)} 12 - 2(3y - 2)(3y + 2) - (2y + 5)(y - 4)$$

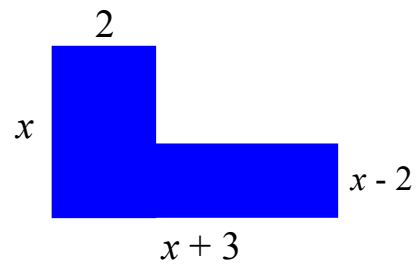
5a) $(2x + 3)^2$

b) $(2x + 3)^3$

c) $(x^2 + 3x - 2)(x + 4)$

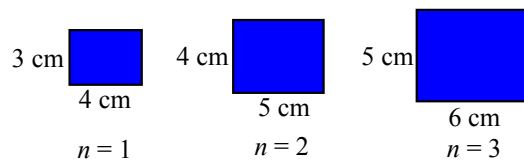
d) $(x^2 - 4x + 1)(x^2 + 3x + 5)$

6) Write and simplify an expression for the area of the following figure.



7) The diagrams show the first three rectangles in a pattern.

a) State the area of the 4th rectangle.



b) Write a product of two binomials to represent the area of the n^{th} rectangle in terms of n .

c) State the area of the 28th rectangle

Answers

- 1)a) $8x + 6$ b) $3yz + 9$ c) $3x + 8$
2)a) $28x^3$ b) $42m^3n^5$ c) $18x^5y^4$
3)a) $7x + 7$ b) $-12x - 73$ c) $-20x - 9$
4)a) $x^2 + 6x + 5$ b) $x^2 - 7x + 12$ c) $c^2 - 6c - 16$
d) $2a^2 - 11a + 15$ e) $4x^2 - 17x - 15$ f) $9a^2 - 25$
g) $2x^2 + 16x + 30$ h) $-8y^2 + 22y + 6$ i) $3x^2 + 13xy + 4y^2$
j) $-6a^2 - ab + 12b^2$ k) $2x^2 + 15x + 30$
l) $12x^2 + 3x + 20$ m) $-20y^2 + 3y + 40$
5)a) $4x^2 + 12x + 9$ b) $8x^3 + 36x^2 + 54x + 27$
c) $x^3 + 7x^2 + 10x - 8$ d) $x^4 - x^3 - 6x^2 - 17x + 5$
6) $x^2 + x - 2$
7)a) 42 cm^2 b) $A = (n + 2)(n + 3)$ c) 930 cm^2

1) Factor each of the following expressions if possible.

a) $15w + 25z$

b) $17ca - 8cd$

c) $12b^4 + 18b^2$

d) $7h + 3m - 5k$

2) Factor each of the following expressions if possible.

a) $14x^2y + 16xy^3$

b) $8s^2y + 11t^3$

c) $7gh + 2mn - 13pq$

d) $27r^2s^2 - 18r^3s^2 - 36rs^3$

3) Factor each of the following expressions if possible.

a) $3x(x + 8) + 5(x + 8)$

b) $a(b + 1) + 9c(b + 1)$

c) $2y(x - 5) + 4(x + 5)$

4) Factor each of the following expressions if possible.

a) $mx + my + 2x + 2y$

b) $x^2 + 3x + 2x + 6$

c) $ay^2 + 3ay + 4y + 12$

5) The formula for the surface area of a cylinder is $SA = 2\pi r^2 + 2\pi rh$

a) Write the formula in factored form

b) If $r = 3$ and $h = 8$, find the surface area using both the original and factored form equations.

6) Factor, if possible.

a) $9a^3 + 27b^2$

b) $24xy^2 - 12xy + 36x^2y$

c) $xy + 12 + 4x + 3y$

Answers

1)a) $5(3w + 5z)$ b) $c(17a - 8d)$ c) $6b^2(2b^2 + 3)$ d) not factorable

2)a) $2xy(7x + 8y^2)$ b) not factorable c) not factorable d) $9rs^2(3r - 2r^2 - 4s)$

3)a) $(x + 8)(3x + 5)$ b) $(b + 1)(a + 9c)$ c) not factorable

4)a) $(x + y)(m + 2)$ b) $(x + 3)(x + 2)$ c) $(y + 3)(ay + 4)$

5)a) $SA = 2\pi r(r + h)$ b) $SA = 66\pi \text{ cm}^2$, or 207.3 cm^2

6)a) $9(a^3 + 3b^2)$ b) $12xy(2y - 1 + 3x)$ c) $(x + 3)(y + 4)$

W3 – Factor $x^2 + bx + c$

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1) Factor, if possible.

a) $x^2 + 7x + 10$

b) $j^2 + 12j + 27$

c) $k^2 + 5k + 4$

d) $p^2 + 9p + 12$

e) $w^2 + 11w + 25$

f) $d^2 + 10d + 24$

2) Factor, if possible.

a) $m^2 - 7m + 10$

b) $x^2 - 5x + 7$

c) $y^2 - 5y + 4$

d) $r^2 - 16r + 64$

e) $w^2 - 9w + 24$

f) $q^2 - 10q + 9$

3) Factor, if possible.

a) $a^2 - 3a - 10$

b) $s^2 + 3s - 10$

c) $d^2 - 8d - 9$

d) $f^2 + 7f - 6$

e) $g^2 - 5g - 14$

f) $r^2 + 2r - 6$

g) $x^2 + x - 42$

h) $b^2 - 2b - 4$

i) $x^2 + xy - 42y^2$

j) $x^2 - 8xy - 48y^2$

k) $x^4 + 11x^2 + 24$

l) $x^2 - 9$

4) Factor, if possible.

a) $3x^2 + 12x + 9$

b) $2d^2 - 22d + 56$

c) $5z^2 + 40z + 60$

d) $4s^2 - 8s - 32$

5) Factor, if possible.

a) $x^4 + 10x^2y + 9y^2$

b) $(x + a)^2 + 3(x + a) + 2$

6) Determine binomials that represent the length and width of the rectangle. Then, determine the dimensions of the rectangle if x represents 15 cm.

Area is
 $x^2 + 18x + 80$

Answers

- 1)a) $(x + 5)(x + 2)$ b) $(j + 9)(j + 3)$ c) $(k + 4)(k + 1)$ d) not possible e) not possible f) $(d + 6)(d + 4)$
2)a) $(m - 2)(m - 5)$ b) not possible c) $(y - 4)(y - 1)$ d) $(r - 8)^2$ e) not possible f) $(q - 9)(q - 1)$
3)a) $(a - 5)(a + 2)$ b) $(s + 5)(s - 2)$ c) $(d - 9)(d + 1)$ d) not possible e) $(g - 7)(g + 2)$ f) not possible
g) $(x + 7)(x - 6)$ h) not possible i) $(x + 7y)(x - 6y)$ j) $(x - 12y)(x + 4y)$ k) $(x^2 + 8)(x^2 + 3)$ l) $(x - 3)(x + 3)$
4)a) $3(x + 3)(x + 1)$ b) $2(d - 7)(d - 4)$ c) $5(z + 6)(z + 2)$ d) $4(s - 4)(s + 2)$
5)a) $(x^2 + 9y)(x^2 + y)$ b) $(x + a + 2)(x + a + 1)$
6) $A = (x + 10)(x + 8)$; the rectangle is 25 cm by 23 cm.

W4 – Factor $ax^2 + bx + c$ where $a \neq 1$

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1) Factor, if possible.

a) $2x^2 + 7x + 5$

b) $6y^2 + 19y + 8$

c) $4k^2 + 15k + 9$

d) $3m^2 + 10m + 8$

e) $10w^2 + 15w + 3$

f) $12q^2 + 17q + 6$

g) $4x^2 - 11x + 6$

h) $5n^2 - 11n + 6$

i) $9b^2 - 24b + 7$

j) $3y^2 + 4y - 7$

k) $8k^2 - 6k - 5$

l) $5h^2 - 14h - 3$

m) $3x^2 + 7xy + 2y^2$

n) $2p^2 - 11pq + 5q^2$

o) $9x^2 - 9xy - 4y^2$

p) $8k^2 - 16k + 6$

q) $6m^2 - 14m - 12$

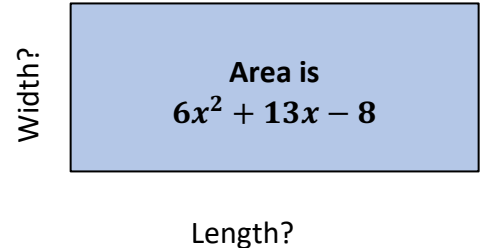
r) $10r^2 - 22r + 4$

s) $2x^3 + 9x^2 + 4x$

t) $5x^2y - 7xy + 2y$

2) A rectangle has area defined by $6x^2 + 13x - 8$.

a) Factor to find algebraic expressions for the length and width



b) If $x = 10$ cm, what is the perimeter and area of the rectangle?

Answers

1) a) $(2x + 5)(x + 1)$ b) $(3y + 8)(2y + 1)$ c) $(4k + 3)(k + 3)$ d) $(3m + 4)(m + 2)$ e) not possible f) $(3q + 2)(4q + 3)$
 g) $(x - 2)(4x - 3)$ h) $5n - 6)(n - 1)$ i) $(3b - 1)(3b - 7)$ j) $(3y + 7)(y - 1)$ k) $(2k + 1)(4k - 5)$ l) $(5h + 1)(h - 3)$
 m) $(3x + y)(x + 2y)$ n) $(2p - q)(p - 5q)$ o) $(3x + y)(3x - 4y)$ p) $2(2k - 1)(2k - 3)$ q) $2(3m + 2)(m - 3)$
 r) $2(5r - 1)(r - 2)$ s) $x(2x + 1)(x + 4)$ t) $y(5x - 2)(x - 1)$
 2) length is $3x + 8$; width is $2x - 1$ b) $P = 114$ cm; $A = 722$ cm²

1) Expand

a) $(x - 4)(x + 4)$

b) $(3y - 2)(3y + 2)$

c) $(5x - 1)(5x + 1)$

d) $(x + 4)^2$

e) $(3x + 2)^2$

f) $(3x + 7y)^2$

2) Factor

a) $x^2 - 25$

b) $y^2 - 49$

c) $9k^2 - 1$

d) $16k^2 - 49$

e) $25w^2 - 36$

f) $4 - 9w^2$

3) Factor

a) $x^2 - y^2$

b) $36x^2 - y^2$

c) $25r^2 - 36s^2$

d) $144r^2 - 49s^2$

e) $121x^2 - 9y^2$

f) $100r^2 - 81s^2$

4) Factor

a) $x^2 + 14x + 49$

b) $x^2 - 6x + 9$

c) $x^2 - 8x + 16$

d) $100 - 20x + x^2$

e) $4x^2 - 12xy + 9y^2$

f) $49x^2 + 56xy + 16y^2$

5) Factor if possible

a) $2a^2 + 12a + 18$

b) $25x^2 - 16y$

c) $75x^2 + 210xy + 147y^2$

d) $9x^3y - 16xy^3$

e) $36m^2 - 96mn + 64n^2$

f) $20x^2 + 20xy + 5y^2$

6) Determine the value(s) of k such that each trinomial is a perfect square.

a) $x^2 + kx + 16$

b) $9x^2 + kx + 49$

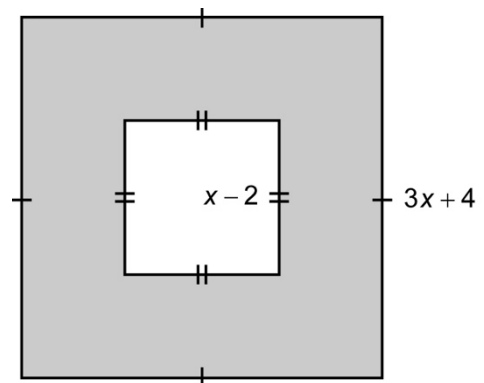
c) $x^2 + 4x + k$

d) $4x^2 - 12x + k$

e) $kx^2 + 40x + 16$

f) $kx^2 - 24xy + 9y^2$

7) Find an algebraic expression for the area of the shaded region in factored form



8) The area of a volleyball court can be represented by the trinomial $2x^2 - 4x + 2$.

a) Factor the trinomial completely

b) If the length of the court is twice the width, use the factors to write the expressions that represent the length and width.

c) If $x = 10$ m, what are the length and width of the court.

Answers

1)a) $x^2 - 16$ b) $9y^2 - 4$ c) $25x^2 - 1$ d) $x^2 + 8x + 16$ e) $9x^2 + 12x + 4$ f) $9x^2 + 42xy + 49y^2$

2)a) $(x - 5)(x + 5)$ b) $(y - 7)(y + 7)$ c) $(3k - 1)(3k + 1)$ d) $(4k - 7)(4k + 7)$ e) $(5w - 6)(5w + 6)$ f) $(2 - 3w)(2 + 3w)$

3)a) $(x - y)(x + y)$ b) $(6x - y)(6x + y)$ c) $(5r - 6s)(5r + 6s)$ d) $(12r - 7s)(12r + 7s)$ e) $(11x - 3y)(11x + 3y)$

f) $(10r - 9s)(10r + 9s)$

4)a) $(x + 7)^2$ b) $(x - 3)^2$ c) $(x - 4)^2$ d) $(10 - x)^2$ e) $(2x - 3y)^2$ f) $(7x + 4y)^2$

5)a) $2(a + 3)^2$ b) not possible c) $3(5x + 7y)^2$ d) $xy(3x - 4y)(3x + 4y)$ e) $4(3m - 4n)^2$ f) $5(2x + y)^2$

6)a) ± 8 b) ± 42 c) 4 d) 9 e) 25 f) 16

7) $A = 4(x + 3)(2x + 1)$

8)a) $2(x - 1)^2$ b) $2(x - 1), x - 1$ c) 18m by 9m