

Factoring

3 – Factoring with Special Rules

Factor each using the difference of two squares, the difference or sum of two cubes, or a perfect square trinomial.

$$\#1) 16n^2 - 9 = (4n-3)(4n+3)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? 4n \\ 2) \text{ Is LAST } \square? 3 \\ 3) \text{ Difference? YES} \end{array}$$

$$\#2) 4m^2 - 25 = (2m-5)(2m+5)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? 2m \\ 2) \text{ Is LAST } \square? 5 \\ 3) \text{ Difference? YES} \end{array}$$

$$\#3) 16x^2 - 40x + 25 = (4x-5)^2$$

$$\begin{array}{l} \square + \text{trinomial?} \\ \hline 1) \text{ Is 1st } \square? 4x \\ 2) \text{ Is LAST } \square? 5 \\ 3) 2\sqrt{\text{1st}}\sqrt{\text{last}} = \text{middle? } 2(4x) \cdot 5 = 40x \end{array}$$

$$\#4) 4x^2 - 4x + 1 = (2x-1)^2$$

$$\begin{array}{l} \square + \text{trinomial?} \\ \hline 1) \text{ Is 1st } \square? 2x \\ 2) \text{ Is LAST } \square? 1 \\ 3) 2\sqrt{\text{1st}}\sqrt{\text{last}} = \text{middle? } 2(1)(2x) = 4x \end{array}$$

$$\#5) 9x^2 - 1 = (3x-1)(3x+1)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? 3x \\ 2) \text{ Is LAST } \square? 1 \\ 3) \text{ Difference? YES} \end{array}$$

$$\#6) x^2 - 25 = (x-5)(x+5)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? x \\ 2) \text{ Is LAST } \square? 5 \\ 3) \text{ Difference? YES} \end{array}$$

$$\#7) x^4 - 100 = (x^2-10)(x^2+10)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? x^2 \\ 2) \text{ Is LAST } \square? 10 \\ 3) \text{ Difference? YES} \end{array}$$

$$\#8) x^4 - 9 = (x^2-3)(x^2+3)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? x^2 \\ 2) \text{ Is LAST } \square? 3 \\ 3) \text{ Difference? YES} \end{array}$$

$$\#9) x^4 - 36 = (x^2-6)(x^2+6)$$

$$\begin{array}{l} \square - \square? \\ \hline 1) \text{ Is 1st } \square? x^2 \\ 2) \text{ Is LAST } \square? 6 \\ 3) \text{ Difference? YES} \end{array}$$

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$$\#10) x^4 - 49 = (x^2 - 7)(x^2 + 7)$$

- - □?
- 1) Is 1st □? x^2
 - 2) Is LAST □? 7
 - 3) Difference? YES

$$\#11) 98x^2 - 200 = 2[49x^2 - 100]$$

$$\boxed{GCF = 2} = 2(7x - 10)(7x + 10)$$

- - □?
- 1) Is 1st □? $7x$
 - 2) Is LAST □? 10
 - 3) Difference? YES

$$\#12) 3 + 6x + 3x^2$$

$$= 3x^2 + 6x + 3$$

$$= 3(x^2 + 2x + 1)$$

$$= 3(x + 1)^2$$

- + trinomial?
- 1) Is 1st □? x
 - 2) Is LAST □? 1
 - 3) $2\sqrt{1^{st}}\sqrt{last} = middle?$ $2(1)(x) = 2x$

$$\#13) 400 - 36x^2$$

$$= -36x^2 + 400$$

$$= -4(9x^2 - 100)$$

$$= -4(3x - 10)(3x + 10)$$

- - □?
- 1) Is 1st □? $3x$
 - 2) Is LAST □? 10
 - 3) Difference? YES

$$\#14) 100x^2 + 180x + 81 = (10x + 9)^2$$

- + trinomial?
- 1) Is 1st □? $10x$
 - 2) Is LAST □? 9
 - 3) $2\sqrt{1^{st}}\sqrt{last} = middle?$ $2(9)(10x) = 180x$

$$\#15) 10x^2 + 100x + 250 = 10[x^2 + 10x + 25]$$

$$GCF = 10 = 10(x + 5)^2$$

- + trinomial?
- 1) Is 1st □? x
 - 2) Is LAST □? 5
 - 3) $2\sqrt{1^{st}}\sqrt{last} = middle?$ $2(x)(5) = 10x$

$$\#16) 49x^2 - 56x + 16 = (7x - 4)^2$$

- + trinomial?
- 1) Is 1st □? $7x$
 - 2) Is LAST □? 4
 - 3) $2\sqrt{1^{st}}\sqrt{last} = middle?$ $2(7x)(4) = 56x$

$$\#17) 49x^2 - 100 = (7x - 10)(7x + 10)$$

- - □?
- 1) Is 1st □? $7x$
 - 2) Is LAST □? 10
 - 3) Difference? YES

$$\#18) 1 - x^2 = -x^2 + 1$$

$$\boxed{GCF = -1} = -1[x^2 - 1]$$

$$= -1(x - 1)(x + 1)$$

- - □?
- 1) Is 1st □? x
 - 2) Is LAST □? 1
 - 3) Difference? YES

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#19) $x^2 + 125$

Prime

$$\frac{\square - \square?}{\text{1) Is 1st } \square? \text{ Yes}}$$

$$\text{2) Is LAST } \square? \text{ NO}$$

$$\text{3) Difference? NO}$$

#20) $m^3 + 64 = (m+4)(m^2 - 4m + 16)$

$$\frac{\square + \square?}{\text{1) Is 1st } \square? \text{ m}}$$

$$\text{2) Is LAST } \square? \text{ 4}$$

#21) $m^3 - 64 = (m-4)(m^2 + 4m + 16)$

$$\frac{\square - \square?}{\text{1) Is 1st } \square? \text{ m}}$$

$$\text{2) Is LAST } \square? \text{ 4}$$

#22) $x^3 + 1 = (x+1)(x^2 - x + 1)$

$$\frac{\square + \square?}{\text{1) Is 1st } \square? \text{ x}}$$

$$\text{2) Is LAST } \square? \text{ 1}$$

#23) $x^3 - 27 = (x-3)(x^2 + 3x + 9)$

$$\frac{\square - \square?}{\text{1) Is 1st } \square? \text{ x}}$$

$$\text{2) Is LAST } \square? \text{ 3}$$

$$\begin{aligned} \#24) 125 - x^3 &= -x^3 + 125 \\ &= -1[x^3 - 125] \\ &= -1(x-5)(x^2 + 5x + 25) \end{aligned}$$

$$\frac{\square - \square?}{\text{1) Is 1st } \square? \text{ x}}$$

$$\text{2) Is LAST } \square? \text{ 5}$$

$$\begin{aligned} \#25) 1 - x^3 &= -x^3 + 1 \\ &= -1[x^3 - 1] \\ &= -1(x-1)(x^2 + x + 1) \end{aligned}$$

$$\frac{\square - \square?}{\text{1) Is 1st } \square? \text{ x}}$$

$$\text{2) Is LAST } \square? \text{ 1}$$

#26) $x^3 + 125 = (x+5)(x^2 - 5x + 25)$

$$\frac{\square + \square?}{\text{1) Is 1st } \square? \text{ x}}$$

$$\text{2) Is LAST } \square? \text{ 5}$$

$$\begin{aligned} \#27) -x^3 - 8 &= -1[x^3 + 8] \\ &= -1(x+2)(x^2 - 2x + 4) \end{aligned}$$

$$\frac{\square + \square?}{\text{1) Is 1st } \square? \text{ x}}$$

$$\text{2) Is LAST } \square? \text{ 2}$$

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$$\begin{aligned} \#28) 250x^4 + 128x &= 2x [125x^3 + 64] \\ &= 2x(5x+4)(25x^2 - 20x + 16) \end{aligned}$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} 5x \\ 2) \text{ I s } \text{LAST} \boxed{?} 4 \end{array}$$

$$\begin{aligned} \#29) 648x + 1029x^4 &= 3x [343x^3 + 216] \\ &= 3x(7x+6)(49x^2 - 42x + 36) \end{aligned}$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} 7x \\ 2) \text{ I s } \text{LAST} \boxed{?} 6 \end{array}$$

$$\#30) 8x^3 + 125 = (2x+5)(4x^2 - 10x + 25)$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} \\ 2) \text{ I s } \text{LAST} \boxed{?} \end{array}$$

$$\#31) 64x^3 + 1 = (4x+1)(16x^2 - 4x + 1)$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} 4x \\ 2) \text{ I s } \text{LAST} \boxed{?} 1 \end{array}$$

$$\begin{aligned} \#32) 8x^4 + x &= x(8x^3 + 1) \\ &= x(2x+1)(4x - 2x + 1) \end{aligned}$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} 2x \\ 2) \text{ I s } \text{LAST} \boxed{?} 1 \end{array}$$

$$\#33) 343x^3 + 64y^3 = (7x+4y)(49x^2 - 28xy + 16y^2)$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} 7x \\ 2) \text{ I s } \text{LAST} \boxed{?} 4y \end{array}$$

$$\#34) x^3 + 8y^3 = (x+2y)(x^2 - 2xy + 4y^2)$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} x \\ 2) \text{ I s } \text{LAST} \boxed{?} 2y \end{array}$$

$$\begin{aligned} \#35) 1029x^3y - 24y^4 &= 3y(343x^3 - 8y^3) \\ &= 3y(7x-2y)(49x^2 + 14xy + 4y^2) \end{aligned}$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} 7x \\ 2) \text{ I s } \text{LAST} \boxed{?} 2y \end{array}$$

$$\begin{aligned} \#36) 1 - x^3 &= -1(x^3 - 1) \\ &= -1(x-1)(x^2 + x + 1) \end{aligned}$$

$$\begin{array}{l} \boxed{+} \boxed{?} \\ \hline 1) \text{ I s } 1^{\text{st}} \boxed{?} x \\ 2) \text{ I s } \text{LAST} \boxed{?} 1 \end{array}$$