Not to know is bad; not to wish to know is worse.

- African proverb

Basic: First factor any **common** **Number** , **Variable** or **Expression** with the **smallest exponent.**

$18x+36=18(x+2)$ $65y^{10}+35y^{6}=5y^{6}(13y^{4}+7)$

$8m^{3}n+24mn^{3}=8mn(m^{2}+3n^{2})$ $13y^{8}+26y^{4}-39y^{2}=13y^{2}(y^{6}+2y^{2}-3)$

$p(p+4)+3(p+4)=(p+4)(p+3)$

Grouping: Take **every two terms**, factor each, and then **factor** each expression in **( )**

$18r^{2}+12ry-3xr-2xy=6r(3r+2y)-x(3r+2y)=(3r+2y)(6r-x)$

2 Terms $a^{2}-b^{2}=(a+b)(a-b)$ Both squared, and the **sign** between two terms **must** be **negative**

$9x^{2}-25y^{2}=(3x+5y)(3x-5y)$ $16k^{4}-1=(4k^{2}+1)(4k^{2}-1)=(4k^{2}+1)(2k+1)(2k-1)$

$9x^{2}+25y^{2}=$ Can **not be factored** because of the positive **sign** in between is **positive**.

2 Terms **both cubed** $a^{3}+b^{3}=(a+b)(a^{2}+b^{2}-ab)$ **or** $a^{3}-b^{3}=(a-b)(a^{2}+b^{2}+ab)$

$8a^{3}+27=(2a+3)(4a^{2}+9-6a)$ $125a^{3}-64b^{3}=(5a-4b)(25a^{2}+16b^{2}+20b)$

3 Terms $x^{2}+bx+c$ *when* $Sum=b$ *and* $\text{Pr}oduct=c$

$x^{2}+5x+6$ $S=5$ $P=6$ $2,3$ $(x+2)(x+3)$

$x^{2}-2x-15$ $S=-2$ $P=-15$ $3,-5$ $(x+3)(x-5)$

3 Terms ax^2+bx+c *when* $Sum=b$ *and* $\text{Pr}oduct=ac$

$21m^2+13x+2 \quad S=13 \quad and \quad \text{P}=21(2)=42 \qquad 7,6$

$21m^2+7m+6m+2=7m(3m+1)+2(3m+1)=(3m+1)(7m+2)$

$4x^2+3x-10 \quad S=3 \quad and \quad \text{P}=4(-10)=-40 \qquad 8,-5$

$4x^2+8x-5x-10=4x(x+2)-5(x+2)=(x+2)(4x-5)$

3 Terms $ax^2+2abx+c^2$ **Two Squared Terms (Check doubling effect)**

$x^2+10x+25=(x+5)^2$ $\qquad 3x^2-48x+192=3(x^2-16x+64)=3(x-8)^2$

$49x^2-28xy+9y^2=(7x-3y)^2$ $\qquad m^2+\frac{2}{3}m+\frac{1}{9}=(m+\frac{1}{3})^2$

ZFP (**Z**ero **F**actor **P**roperty) to **solve equations** that **can be factored**.

1. Have zero on one side. **2**. Factor the other side. **3**. Let each factor $=0$ and solve.

$x^2-3x=4, \qquad x^2-3x-4=0$ **2.** $(x-4)(x+1)=0,$ $\qquad (x-4)=0, \quad (x+1)=0$

$x=4, \qquad x=-1$

Practice Problems

1. $15x^3-30x^2$ **2.** $100a^5+16a^3$ **3**. $x^6y^2+5x^4y^3-6xy^4+10xy$

4. $3a^3+3ab^2+2a^2b+2b^3$ **5**. $c(x+2)-d(x+2)$ **6**. $x^2+15x+44$

7. $x^2+6x-27$ **8.** $x^2-14x+24$ **9.** $n^2-12n-35$

10. x^2-2x-3 **11**. $7x^2+8x+1$ **12**. $21m^2+13m+2$

13. $10x^2+11x-6$ **14**. $2m^3+2m^2-40m$ **15**. $6x^2-7x-5$

16. $6x^2-7x\,y-5y^2$ **17**. $x^2-10x+25$ **18**. $2x^2+24x+72$

19. $49x^2-28x\,y+4y^2$ **20**. $16x^2-40x+25$ **21**. $4x^2-9y^2$

22. $36x^2-1$

Solve each equation by **ZFP** Method

23. $x^2+6x-27=0$ **24**. $2y^2-18=0$

25. $3x^2+5x-2=0$

26. $x^2=-5x+24$

27. $m^2+8m=-16$

28. $36x^2+60x=-25$

Answers

1. $15x^2(x-2)$

2. $4a^3(25a^2+4)$

3. $xy(x^5y+5x^3y^2-6y^3+10)$

4. $3a(a^2+b^2)+2b(a^2+b^2)=$ ***(a² + b²)(3a + 2b)***

5. $(x+2)(c-d)$

6. $(x+4)(x+11)$

7. $(x+9)(x-3)$

8. $(x-12)(x-2)$

9. Pr*ime*

10. $(x-3)(x+1)$

11. $(7x+1)(x+1)$

12. $(3m+1)(7m+2)$

13. $(2x+3)(5x-2)$

14. $2m(m-4)(m+5)$

15. $(3x-5)(2x+1)$

16. $(3x-5y)(2x+y)$

17. $(x-5)^2$

18. $2(x+6)^2$

19. $(7x-2y)^2$

20. $(4x-5)^2$

21. $(2x+3y)(2x-3y)$

22. $(6x+1)(6x-1)$

23. $(x+9)(x-3)=0, \quad x=-9,\ 3$

24. $2(y+3)(y-3)=0 \quad y=-3,\ 3$

25. $(3x-1)(x+2)=0 \quad x=\frac{1}{3},\ -2$

26. $(x+8)(x-3)=0 \quad x=-8,\ 3$

27. $(m+4)^2=0 \quad m=-4$

28. $(6x+5)^2=0 \quad x=-\frac{5}{6}$