Name: ______________________ Date: ______________________ Hour: ____Alg 1____

Unit 7C Day 31: Factoring when a ≠ 1 but is the GCF

Focus Question: How do I factor $ax^2 + bx + c$ when $a \neq 1$?

A. Review: Factor each of the following

1) $3x^2 + 27x$

$3x(x)+3x(9)$

$3x(x+9)$

2) $x^2 - 13x - 30$

-30: $1\cdot30$, $2\cdot15$, $3\cdot10$, $5\cdot6$

$x^2-15x+2x-30$

$x(x)+x(-15)+2(x)+2(-15)$

$x(x-15)+2(x-15)$ $\quad -15+2$

$(x-15)(x+2)$

3) $4x^2 + 24x - 160$

-40: $1\cdot40$, $2\cdot20$, $4\cdot10$, $5\cdot8$ $\quad 10-4$

$4(x^2+6x-40)$

$4(x^2+10x-4x-40)$

$4[x(x)+x(10)-4(x)-4(10)]$

$4[x(x+10)-4(x+10)]$

$\boxed{4(x+10)(x-4)}$

4) How is problem three different from the quadratics we have factored before?

Trinomial & $a \neq 1$

5) When factoring, what should you ALWAYS look for first?

a GCF (especially if $a \neq 1$)

Remember, your greatest common factor becomes the *a* value, so sometimes it's negative and sometimes it's a fraction.

B: Re-write each standard form quadratic in intercept form.

1) $f(x) = 5x^2 + 10x - 15$

-3: $1\cdot3$ $\quad 3-1$

$=5(x^2+2x-3)$

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

$=5[x(x)+x(3)-1(x)-1(3)]$

$=5[x(x+3)-1(x+3)]$

$f(x)=5(x+3)(x-1)$

2) $g(x) = 2x^2 + 6x - 108$

-54: $1\cdot54$, $2\cdot27$, $3\cdot18$, $6\cdot9$ $\quad 9-6$

$=2(x^2+3x-54)$

$=2(x^2+9x-6x-54)$

$=2[x(x)+x(9)-6(x)-6(9)]$

$=2[x(x+9)-6(x+9)]$

$\boxed{=2(x+9)(x-6)}$

3) $h(x) = 4x^2 + 20x + 24$

6: $1\cdot6$, $2\cdot3$ $\quad \cancel{6+1}$ $\quad 2+3$

$=4(x^2+5x+6)$

$=4(x^2+2x+3x+6)$

$=4[x(x)+x(2)+3(x)+3(2)]$

$=4[x(x+2)+3(x+2)]$

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

4) $f(x) = 3x^2 - 147$

49: $1\cdot49$, $7\cdot7$ $\quad 7-7$

$=3(x^2-49)$

$=3(x^2+7x-7x-49)$

$=3[x(x)+x(7)-7(x)-7(7)]$

$=3[x(x+7)-7(x+7)]$

$=3(x+7)(x-7)$

5) $h(x) = \frac{1}{2}x^2 + 12x + 72$

$\frac{144}{12 \cdot 12}$

$= \frac{1}{2}(x^2+24x+144)$

$= \frac{1}{2}(x^2+12x+12x+144)$

$= \frac{1}{2}[x(x)+x(12)+12(x)+12(12)]$

$= \frac{1}{2}[(x)(x+12)+12(x+12)]$

$= \frac{1}{2}(x+12)^2$ $\frac{1}{2}(x+12)(x+12)$

6) $k(x) = -2x^4 + 6x^3 + 8x^2$

$\frac{-4}{1 \cdot 4}$ $2 \cdot 2$ $-4+1$

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

$-2x^2(x^2-4x+1x-4)$

$-2x^2[x(x)+x(-4)+1(x)+1(-4)]$

$-2x^2[x(x-4)+1(x-4)]$

$-2x^2(x-4)(x+1)$

7) $h(t) = 2t^2 + 28t + 96$

48: $1 \cdot 48$, $2 \cdot 24$, $3 \cdot 16$, $4 \cdot 12$, $6 \cdot 8$ $6+8$

$=2(t^2+14t+48)$

$=2(t^2+6t+8t+48)$

$=2[t(t)+t(6)+8(t)+8(6)]$

$=2[t(t+6)+8(t+6)]$

$=2(t+6)(t+8)$

8) $h(s) = \frac{1}{4}s^2 - 1$

$\frac{-4}{1 \cdot 4}$ $\cancel{2 \cdot 2}$ $2 - 2$

$=\frac{1}{4}(s^2-4)$

$=\frac{1}{4}(s^2+2s-2s-4)$

$=\frac{1}{4}[s(s)+s(2)-2(s)-2(2)]$

$=\frac{1}{4}[s(s+2)-2(s+2)]$

$=\frac{1}{4}(s+2)(s-2)$

C. Applications of factoring

1. A bottlenose dolphin jumps out of the water. The path the dolphin travels can be modeled by $h(d) = -2d^2 - 24d$, here h represents height of the dolphin in feet and d represents horizontal distance in feet.

a. How far did the dolphin jump? x int. dist.

$0 - -12 = \boxed{12ft}$

$0=-2d^2-24d$

$0=-2d(d+12)$

$d=0$ or $d+12=0$

$-12 \quad -12$

$\boxed{d=-12}$

b. What is the maximum height the dolphin reaches?

y part of vertex

a.o.s. $x=\frac{0+-12}{2}$

$x=-6$

$h(-6)=-2(-6)^2-24(-6)$

$=-2(36)+144$

$=-72+144$

$\boxed{72\ ft}$

2. A diet coke and mentos rocket was launched off the top of a building by the president of the rocketry club in a lead up to a challenge. The height in feet, h, of the rocket can be modeled by the function $h(t) = -16t^2 + 80t + 96$ where t is the time in seconds since launch.

a. How long was the rocket in the air?

$\frac{0}{-16}=\frac{-16t^2}{-16}+\frac{80t}{-16}+\frac{96}{-16}$

$\boxed{6 sec}$

$0=t^2-5t-6$

$\frac{-6}{1 \cdot 6}$ $2 \cdot 3$ $-6+1$ $\cancel{-3+2}$

$0=t^2-6t+1t-6$

$0=(t-6)(t+1)$

$t-6=0$ $+6 \quad +6$ $t+1=0$ $-1 \quad -1$

$t=6$ or $t=-1$

neg. time!!

b. How high did the rocket go? $\boxed{196\ ft}$

y part vertx

a.o.s. $x=\frac{6+-1}{2} \Rightarrow \frac{5}{2}$

$h(\frac{5}{2})=-16(\frac{5}{2})^2+80(\frac{5}{2})+96$

$=-16(\frac{25}{4})+40 \cdot 5+96$

$=-4 \cdot 25+200+96$

$=-100+296$