M^2 = Math Mediator Lesson 29: Factoring Quadratics 2

**THIS LESSON REQUIRES SOME MATERIALS: TENNIS BALLS OR OBJECTS TO TOSS IN AIR!

Total Recall (Warm-up) (5 minutes approx.)

Total Recall: 2 exercises from yesterday's lesson on Factoring Quadratics

1. Factor the following trinomial quadratic: $x^2 – 5x + 6$: A. $(x – 2)(x – 3)$

2. Factor the following trinomial quadratic: $x^2 + 2x – 120$: A. $(x – 10)(x + 12)$

Direct Instruction (10 minutes approx.)

CA Std 8.0

The Ramona fire department has a new hose truck that sprays from a 4 meter tall truck mount. There is a fire on the roof of a 24 meter tall building. Rounding off the effects of gravity from –4.9 m/s to –5 m/s and assuming the water leaves the hose at 29 m/s; use the formula for height ($h = -5t^2 + v_0t + h_0$) to find the following:

1. Will the water clear the top of the building?
2. If it does clear, at what time will this happen?
3. Answer: $h = -5t^2 + v_0t + h_0 = -5t^2 + 29t - 20 = -1(5t^2 – 29t + 20) = -1(5x – 4)(x – 5)$; the method of factoring this was trial and error using a table:

First term factors R x S = 5	5, 1	5, 1	5, 1	5, 1
Last Term factors T x V = 20	–10, -2	-10, -2	–5, -4	–4, -5
(Rx + T)(Sx + V)	(5x – 10)(x – 2)	(5x – 2)(x – 10)	(5x – 5)(x – 4)	(5x – 4)(x – 5)
$5x^2 – 29x + 20$???	$5x^2 – 20x + 20$ NO	$5x^2 – 52x + 20$ NO	$5x^2 – 25x + 20$ NO	$5x^2 – 29x + 20$ YES!

4. With the factors completed, the zeroes can be determined and are $t = 4/5$ and $t = 5$. In between the two is the maximum, which is $t = 2.9$ seconds. Substituting 2.9 seconds into the formula produces a height of 22.05 plus the 24 meters. The water will clear the wall by 22 plus meters. When the quadratic equals 0, then it will be at 24 meters, which happens at 4/5 second and 5 seconds. In between these times the water spray is above the wall.

Practice: (7 minutes approx.)

U-DO: Factor the following:

1. $4x^2 – x – 3$ Answer: $(4x + 3)(x – 1)$
2. $3x^2 – 4x + 1$ Answer: $(3x – 1)(x – 1)$
3. $6x^2 + 13x + 6$ Answer: $(2x + 3)(3x + 2)$
4. $4x^2 + x + 3$ Answer: No solution: the graph does not cross the x axis.

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Direct Instruction (7 minutes approx.)	Special Quadratics to look for: 1. No x term: check for difference of squares (middle term drops out): a. $36x^2 - 1$: $(6x + 1)(6x - 1)$ *sq. rt. of both terms b. $9x^2 - 4$: $(3x + 2)(3x - 2)$ 2. Common Factor: a. $45x^2 - 20$: $5(9x^2 - 4) = 5(3x + 2)(3x - 2)$ b. $25x^2 + 20x$: $5x(5x + 4)$
Practice and Assessment: (8 minutes approx.)	U-DO: Factor the following: 1. $3t^2 - 48$ Answer: $3(t^2 - 16) = 3(t + 4)(t - 4)$ 2. $9r^2 + 36r + 27$ Answer: $9(r^2 + 4r + 3) = 9(r + 3)(r + 1)$ 3. $4x^2 + 20x + 25$ Answer: $(4x + 5)(4x + 5)$ *Notice with this factoring, there are two zeroes of the same value: -4/5. Why is that? Because this quadratic just touches the x-axis. So, only one zero point.
Activity (15 minutes approx.) ** Tennis balls or some objects required to toss into air and time. Use stop watch to time.	Divide the class up into small groups: 1. High Toss: Toss an object into the air about 4 meters or 12 feet, and record the time from when the object leaves your hand to when you catch it. Record 4 tosses and take the average. Using the height formula of $h = -5t^2 + v_0t + h_0$ and substitute the zero time height as 0 meters: $h_0 = 0$; and the average height, h = 4 meters; and then solve for the initial velocity, v_0, or the speed at which you were tossing the object into the air. Answers will vary: should be around 6 m/s. 2. Low Toss: Toss the ball into the air only 1 meter or 3 feet. Time your toss as before and record 4 tosses. Calculate the initial velocity. Answers should be close to 4.5 m/s. 3. How fast in m/s do pitchers throw when they throw at 90 miles/hour? Use the conversions: 1 mile = 2000 meters and 3600 seconds in an hour. a. Answer: $90\frac{miles}{hour}\cdot\frac{1hour}{3600\,seconds}\cdot\frac{2000meters}{1mile} = 50\frac{meters}{second}$
Wrap-up (3 minutes approx.)	Wrap up closing comments and housekeeping.