

## 2.1 – Adding & Subtracting Polynomials

- GOAL – Determine whether polynomial expressions are equivalent.



Fred enjoys playing with model rockets. He wants to determine the difference in altitude of two different rockets when their fuel burns out and they begin to coast.

The altitudes, in meters, are given by the equations below:

$$a_1(t) = -5t^2 + 100t + 1000$$

and

$$a_2(t) = -5t^2 + 75t + 1200$$

where  $t$  is time elapsed, in seconds.

# Example: Model Rockets cont'd

- The difference in altitude,  $f(t)$ , is given by:
- $f(t) = (-5t^2 + 100t + 1000) - (-5t^2 + 75t + 1200)$
- Fred simplified  $f(t)$  to  $g(t) = 175t + 2200$ .
- **Are the functions  $f(t)$  and  $g(t)$  equivalent?**
- Let's collect *like terms*:
- $f(t) = (-5 + 5)t^2 + (100 - 75)t + (1000 - 1200)$
- $= 0t^2 + 25t - 200$
- $f(t) = 25t - 200$
- Therefore, the equations are *not* equivalent.

## Example #2 - Reasoning

- Nigel and Petra are hosting a dinner for 300 guests. Cheers banquet hall has quoted these charges:
- \$500, plus \$10 per person, for food
- \$200, plus \$20 per person, for drinks, and
- a discount of \$5 per person if the number of guests exceeds 200

Nigel and Petra have created 2 different functions for the total cost, where  $n$  represents the number of guests and  $n > 200$ .

Nigel's cost function:  $C_1(n) = (10n + 500) + (20n + 200) - 5n$

Petra's cost function:  $C_2(n) = (10n + 20n - 5n) + (500 + 200)$

**Are the functions equivalent?**

## Example #2 – Reasoning cont'd

- If both functions simplify to the same expression, then they are equivalent:

$$C_1(n) = (10n + 500) + (20n + 200) - 5n$$

$$= 10n + 500 + 20n + 200 - 5n \dots \text{now collect like terms...}$$

$$C_1(n) = 25n + 700$$

$$C_2(n) = (10n + 20n - 5n) + (500 + 200)$$

$$= 10n + 20n - 5n + 500 + 200$$

$$C_2(n) = 25n + 700$$

**Therefore, the two cost functions are equivalent.**

## Example #3

- Are the functions  $xy + xz + yz$  and  $x^2 + y^2 + z^2$  equivalent?
- If there is at least one point that does not satisfy both equations, then there are not equivalent.
- We can try the point  $(x, y, z) = (0, 0, 1)$ :
- $xy + xz + yz = 0(0) + 0(1) + 0(1) = 0$
- $x^2 + y^2 + z^2 = (0)^2 + (0)^2 + (1)^2 = 1$
- Therefore the expressions are *not* equivalent.

# In Summary...

- Two polynomial functions or expressions are equivalent if
  - > They simplify algebraically to give the same function or expression
  - > They produce the same graph

Two polynomial functions or expressions are *not* equivalent if

> they result in different values when they are evaluated with the same numbers substituted for the variable(s)