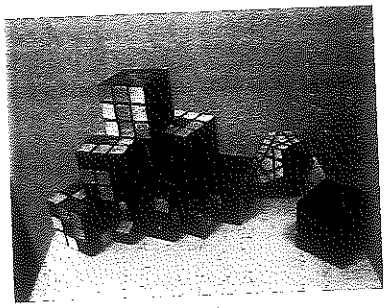
3.2 You-mix Cubes

A Solidify Understanding Task

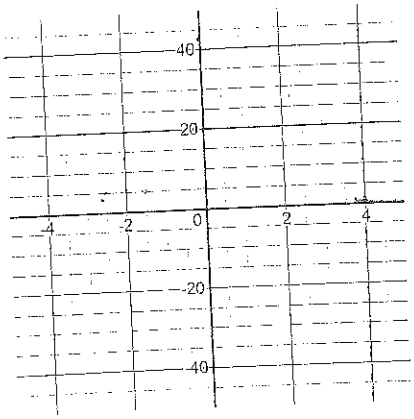


In Scott's March Madness, the function that was generated by the sum of terms in a quadratic function was called a **cubic function**. Linear functions, quadratic functions, and cubic functions are all in the family of functions called **polynomials,** which include functions of higher powers too. In this task, we will explore more about cubic functions to help us to see some of the similarities and differences between cubic functions and quadratic functions.

To begin, let's take a look at the most basic cubic function, $f(x) = x^3$. It is technically a **degree 3 polynomial** because the highest exponent is 3, but it's called a cubic function because these functions are often used to model volume. This is like quadratic functions which are **degree 2** polynomials but are called quadratic after the Latin word for square. Scott's March Madness showed that linear functions have a constant rate of change, quadratic functions have a linear rate of change, and cubic functions have a quadratic rate of change.

1. Use a table to verify that $f(x) = x^3$ has a quadratic rate of change.

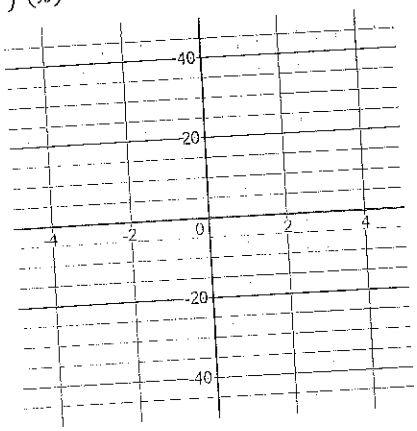
2. Graph $f(x) = x^3$.



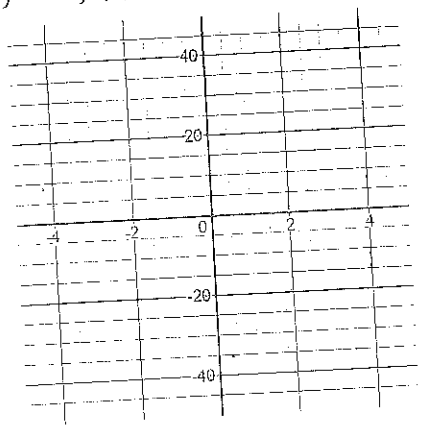
3. Describe the features of $f(x) = x^3$ including intercepts, intervals of increase or decrease, domain, range, etc.

4. Using your knowledge of transformations, graph each of the following without using technology.

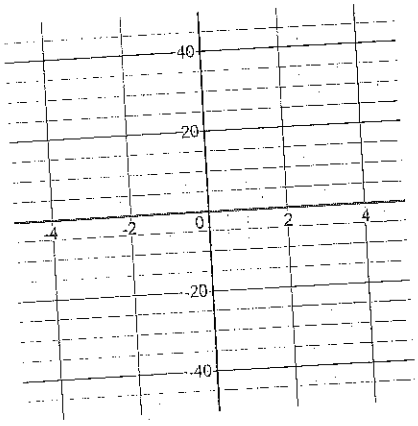
a) $f(x) = x^3 - 3$



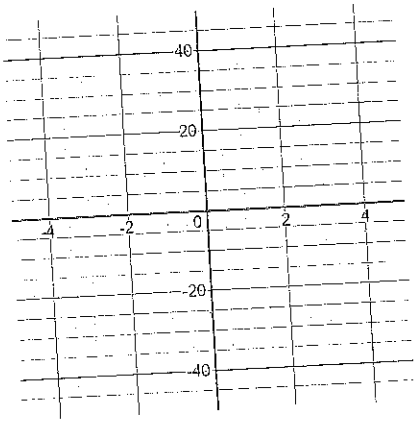
b) $f(x) = (x + 3)^3$



c) $f(x) = 2x^3$



d) $f(x) = -(x - 1)^3 + 2$



5. Use technology to check your graphs above. What transformations did you get right? What areas do you need to improve on so that your cubic graphs are perfect?

6. Since quadratic functions and cubic functions are both in the polynomial family of functions, we would expect them to share some common characteristics. List all the similarities between $f(x) = x^3$ and $g(x) = x^2$.

7. As you can see from the graph of $f(x) = x^3$, there are also some real differences in cubic functions and quadratic functions. Each of the following statements describe one of those differences. Explain why each statement is true by completing the sentence.

a) The range of $f(x) = x^3$ is $(-\infty, \infty)$, but the range of $g(x) = x^2$ is $[0, \infty)$ because: _____

b) For $x > 1, f(x) > g(x)$ because: _____

c) For $0 < x < 1, g(x) > f(x)$ because: _____

3.2

READY, SET, GO!

Name Period Date

READY

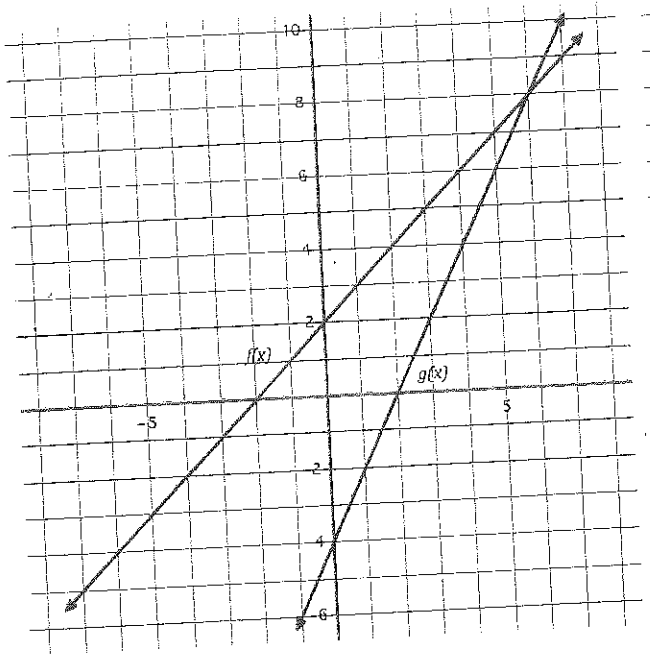
Topic: Adding and subtracting binomials

Add or subtract as indicated.

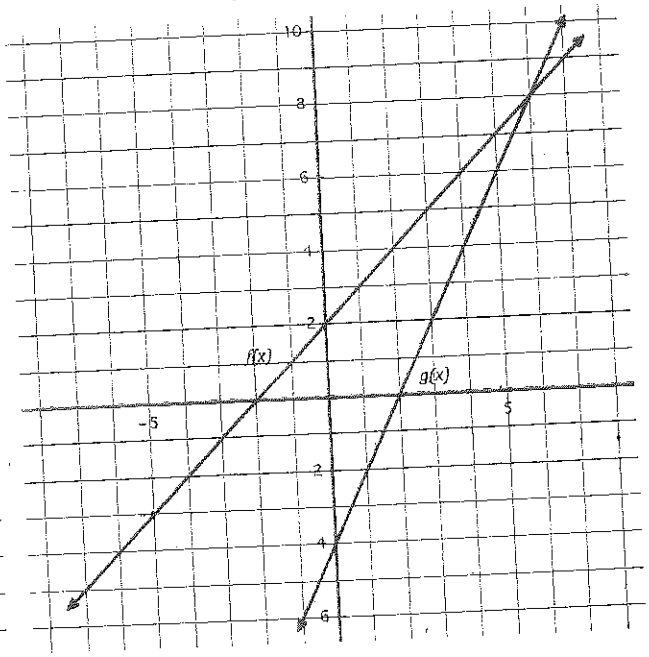
1. $(6x + 3) + (4x + 5)$
2. $(x + 17) + (9x - 13)$
3. $(7x - 8) + (-2x + 9)$
4. $(4x + 9) - (x + 2)$
5. $(-3x - 1) - (2x + 5)$
6. $(8x + 3) - (-10x - 9)$
7. $(3x - 7) + (-3x - 7)$
8. $(-5x + 8) - (-5x + 7)$
9. $(8x + 9) - (7x + 9)$

10. Use the graphs of $f(x)$ and $g(x)$ to sketch the graphs of $f(x) + g(x)$ and $f(x) - g(x)$.

$f(x) + g(x)$



$f(x) - g(x)$.



3.2

SET

Topic: Comparing simple polynomials

11. Complete the tables below for $y = x$ *and* $y = x^3$ *and* $y = x^5$

x	$y = x$
−1	
0	
1	

x	$y = x^3$
−1	
0	
1	

x	$y = x^5$
−1	
0	
1	

12. What assumption might you be tempted to make about the graphs of $y = x$, $y = x^3$ *and* $y = x^5$ based on the values you found in the 3 tables above?

13. What do you really know about the graphs of $y = x$ *and* $y = x^3$ *and* $y = x^5$ despite the values you found in the 3 tables above?

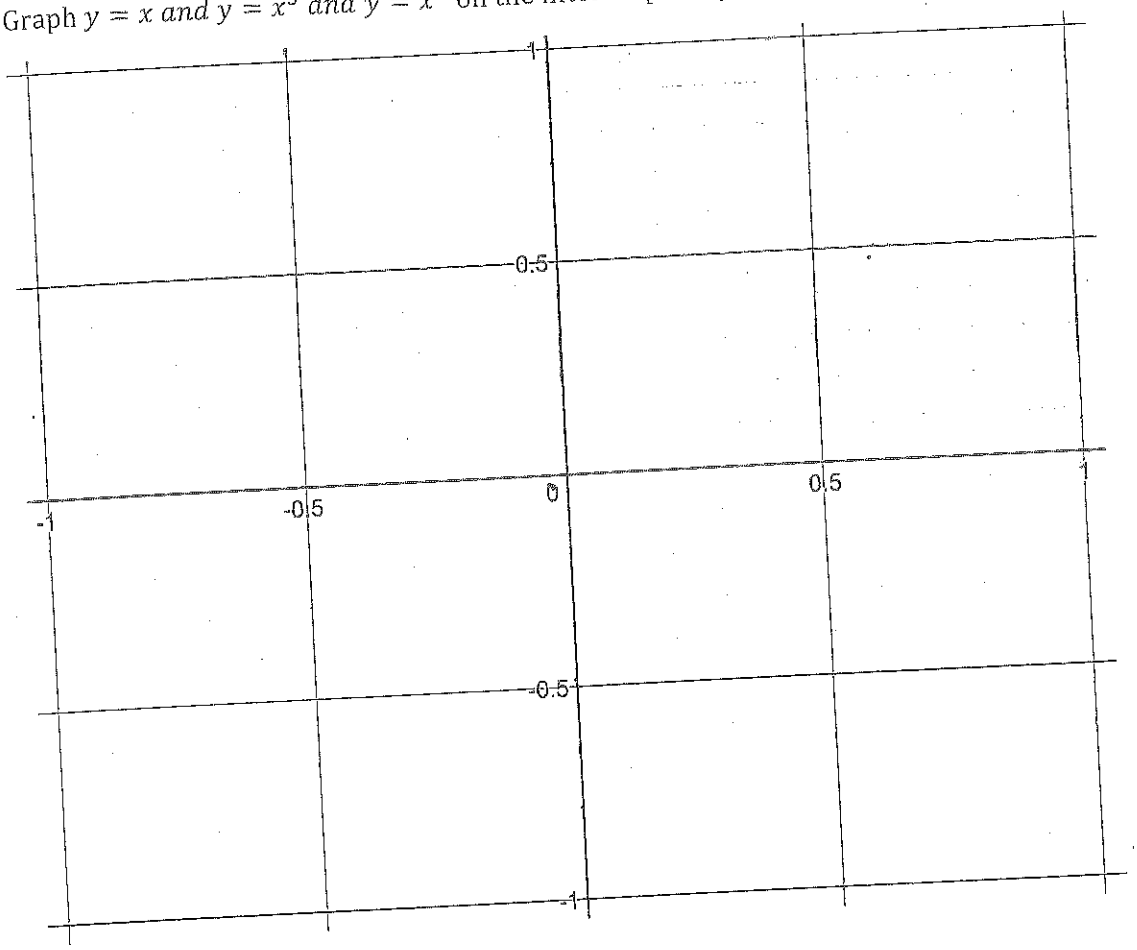
14. Complete the tables with the additional values.

x	$y = x$
−1	
$-1/2$	
0	
$1/2$	
1	

x	$y = x^3$
−1	
$-1/2$	
0	
$1/2$	
1	

x	$y = x^5$
−1	
$-1/2$	
0	
$1/2$	
1	

15. Graph $y = x$ *and* $y = x^3$ *and* $y = x^5$ on the interval $[-1, 1]$, using the same set of axes.



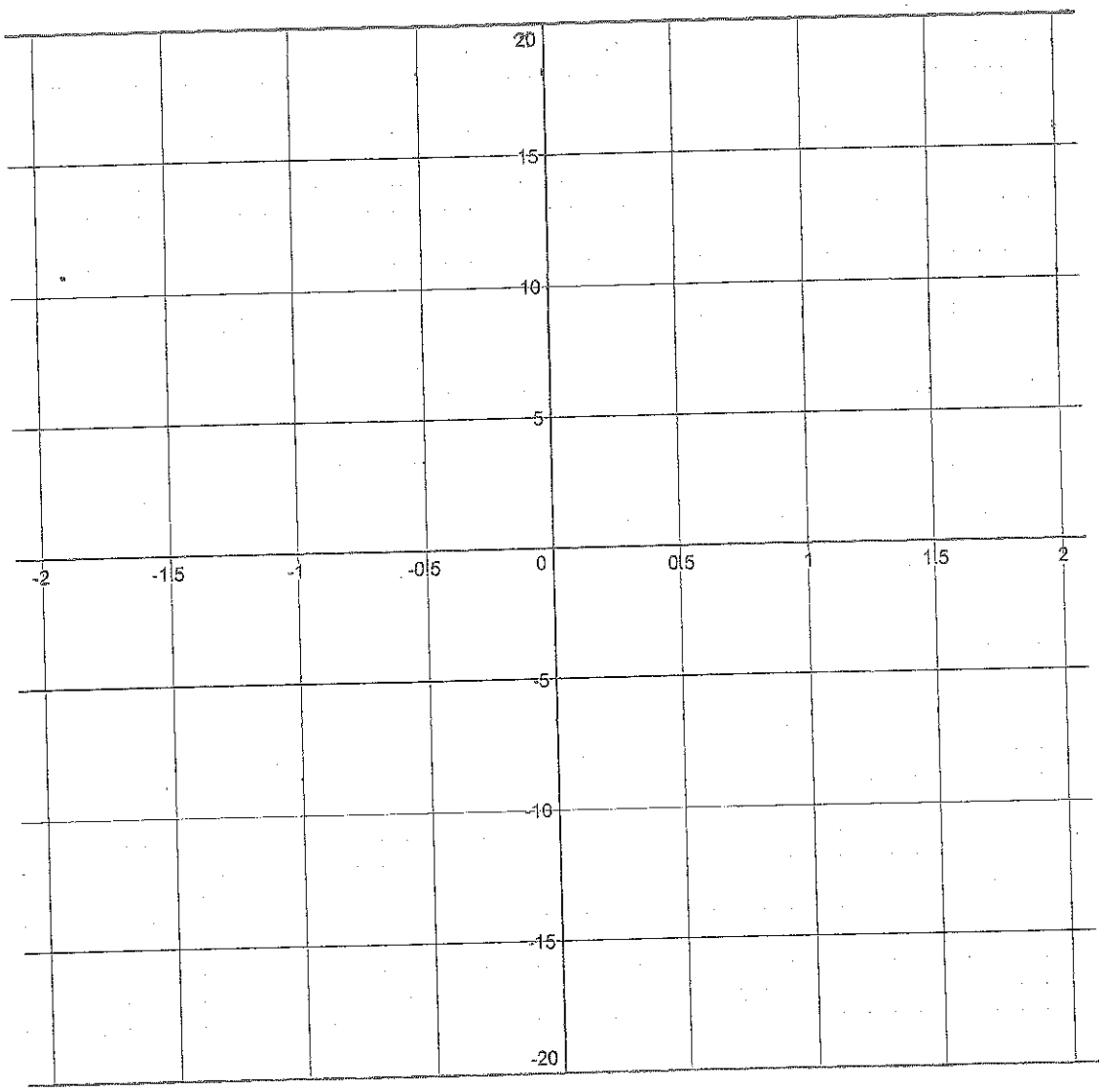
16. Complete the tables with the additional values.

x	$y = x$
-2	
-1	
$-1/2$	
0	
$1/2$	
1	
2	

x	$y = x^3$
-2	
-1	
$-1/2$	
0	
$1/2$	
1	
2	

x	$y = x^5$
-2	
-1	
$-1/2$	
0	
$1/2$	
1	
2	

17. Graph $y = x$ *and* $y = x^3$ *and* $y = x^5$ on the interval [-2, 2], using the same set of axes.



GO
Topic: Using the exponent rules to simplify expressions

Simplify.

18. $x^{1/3} \cdot x^{1/6} \cdot x^{1/4}$

19. $a^{2/5} \cdot a^{3/10} \cdot a^{2/15}$

20. $m^{4/7} \cdot m^{3/14} \cdot m^{5/28}$