Honors Math II
Unit 5 day 5: Writing Polynomial Functions

Name Key
Period ____ Date ____

Write a polynomial function of least degree that has rational coefficients, a leading coefficient of 1 and the given zeros.

1. $x = 3, x = 2$

$y = a(x-3)(x-2)$

$y = a(x^2-5x+6)$

$y = a(x^2-5x+6)$

$a = 1$

$y = x^2-5x+6$

2. $x = \frac{1}{2}, x = -2$

$y = a(x-\frac{1}{2})(x+2)$

$y = a(2x-1)(x+2)$

$y = a(2x^2+3x-2)$

L.C. to be 1 so $a = \frac{1}{2}$

$y = \frac{1}{2}(2x^2+3x-2)$

$y = x^2+\frac{3}{2}x-1$

3. $x = \sqrt{5}, x = -\sqrt{5}$

$y = a(x-\sqrt{5})(x+\sqrt{5})$

$y = a(x^2-5)$

$a = 1$

$y = x^2-5$

4. $x = 3i, x = -3i$

$y = a(x-3i)(x+3i)$

$y = a(x^2+9)$

$a = 1$

$y = x^2+9$

5. $x = 3, x = -2, x = 5$

$y = a(x-3)(x+2)(x-5)$

$y = a(x-3)(x^2-3x-10)$

$y = a(x^3-3x^2-10x$
$-3x^2+9x+30)$

$y = a(x^3-6x^2-x+30)$

$a = 1$

$y = x^3-6x^2-x+30$

6. $x = \frac{2}{3}, x = 6, x = -2$

$y = a(x-\frac{2}{3})(x-6)(x+2)$

$y = a(3x-2)(x-6)(x+2)$

$y = a(3x-2)(x^2-4x-12)$

$y = a(3x^3-12x^2-36x$
$-2x^2+8x+24)$

$y = a(3x^3-14x^2-28x+24)$

$a = \frac{1}{3}$

$y = x^3-\frac{14}{3}x^2-\frac{28}{3}x+8$

7. $x = 2+i, x = 2-i$

$y = a(x-2-i)(x-2+i)$

$y = a(x^2-2x+ix$
$-2x \quad +4-2i$
$-ix \quad +2i \quad -i^2)$

$y = a(x^2-4x+4-i^2)$

$y = a(x^2-4x+4+1)$

$y = a(x^2-4x+5)$

$a = 1$

$y = x^2-4x+5$

8. $x = -1, x = 4, x = 9$

$y = a(x+1)(x-4)(x-9)$

$y = a(x+1)(x^2-13x+36)$

$y = a(x^3-13x^2+36x$
$x^2-13x+36)$

$y = a(x^3-12x^2+23x+36)$

$a = 1$

$y = x^3-12x^2+23x+36$

9. $x = \sqrt{7}, x = -\sqrt{7}$

$y = a(x+\sqrt{7})(x-\sqrt{7})$

$y = a(x^2-7)$

$a = 1$

$y = x^2-7$

Write the equation for the polynomial with the given roots and y-intercept.

10. $(-2,0)$, $(3,0)$, $(-4,0)$, $(0,12)$ ← y-int.

$x=-2 \quad x=3 \quad x=-4$

$y = a(x+2)(x-3)(x+4)$

$12 = a(2)(-3)(+4)$

$12 = -24a$

$\frac{12}{-24} = \frac{-24a}{24}$

$a = -1/2$

$y = -1/2(x+2)(x-3)(x+4)$

$y = -1/2(x+2)(x^2+x-12)$

$y = -1/2(x^3+x^2-12x$
$\quad 2x^2+2x-24)$ → $y = -1/2(x^3+3x^2-10x-24)$

$y = -\frac{1}{2}x^3 - \frac{3}{2}x^2 + 5x + 12$

11. $(-1,0)$, $(-2,0)$, $(6,0)$, $(0,-6)$

$x=-1 \quad x=-2 \quad x=6$

$-6 = a(1)(2)(-6)$

$-6 = -12a$

y-int

$y = a(x+1)(x+2)(x-6)$

$y = \frac{1}{2}(x+1)(x^2-4x-12)$

$y = \frac{1}{2}(x^3-4x^2-12x$
$\quad 1x^2-4x-12)$

$y = \frac{1}{2}(x^3-3x^2-16x-12)$

$y = \frac{1}{2}x^3 - \frac{3}{2}x^2 - 8x - 6$

12. $(-1,0)$, $(1,0)$, $(-5,0)$, $(0,-1)$

$y = a(x+1)(x-1)(x+5)$

$-1 = a(1)(-1)(5)$

$a = 1/5$

$y = 1/5(x+1)(x-1)(x+5)$

$y = 1/5(x+5)(x^2-1)$

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

$y = \frac{1}{5}x^3 + x^2 - \frac{1}{5}x - 1$

13. $(3,0)$, $(-3,0)$, $(4,0)$, $(0,36)$

$y = a(x-3)(x+3)(x-4)$

$36 = a(-3)(3)(-4)$

$36 = 36a$

$a = 1$

$y = 1(x-3)(x+3)(x-4)$

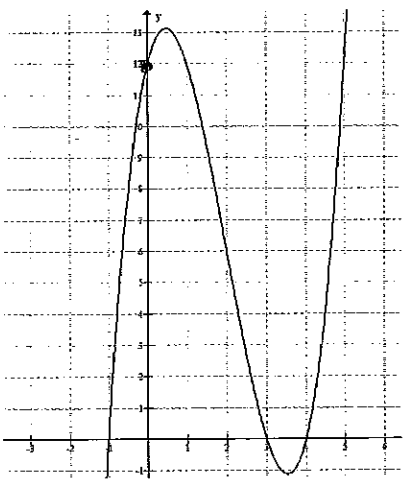
$y = (x^2-9)(x-4)$

$y = x^3 - 4x^2 - 9x + 36$

Write the equation for the given polynomial.

14. $12 = a(1)(-3)(-4)$

$a = 1$



$y = a(x+1)(x-3)(x-4)$

$y = (x+1)(x-3)(x-4)$

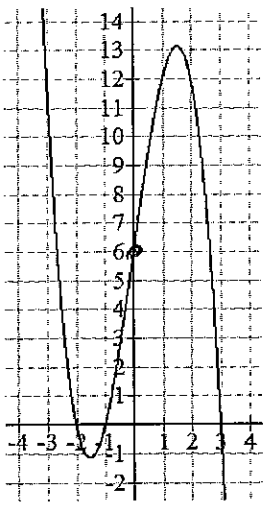
$y = (x+1)(x^2-7x+12)$

$y = (x^3-7x^2+12x$
$\quad +1x^2-7x+12)$

$y = x^3 - 6x^2 + 5x + 12$

15. $6 = a(2)(1)(-3)$

$a = -1$



$y = a(x+2)(x+1)(x-3)$

$y = -1(x+2)(x+1)(x-3)$

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

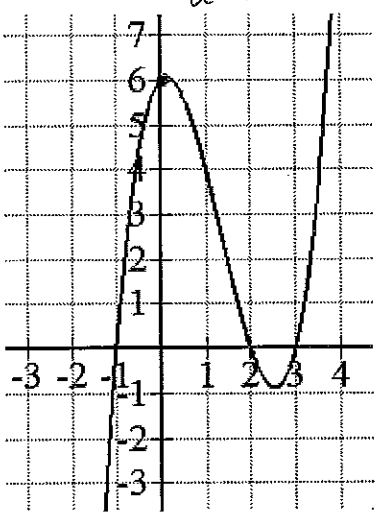
$y = -1(x^3-2x^2-3x$
$\quad 2x^2-4x-6)$

$y = -1(x^3-7x-6)$

$y = -x^3 + 7x + 6$

16. $6 = a(1)(-2)(-3)$

$a = 1$



$y = a(x+1)(x-2)(x-3)$

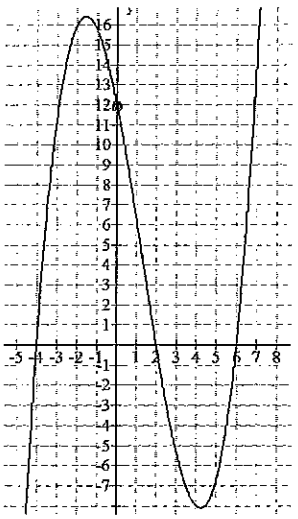
$y = (x+1)(x-2)(x-3)$

$y = (x+1)(x^2-5x+6)$

$y = (x^3-5x^2+6x$
$\quad x^2-5x+6)$

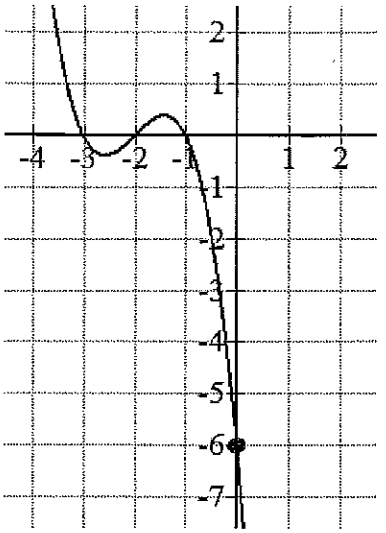
$y = x^3 - 4x^2 + x + 6$

17. $12 = a(4)(-2)(-6)$
$12 = 48a$
$a = 1/4$



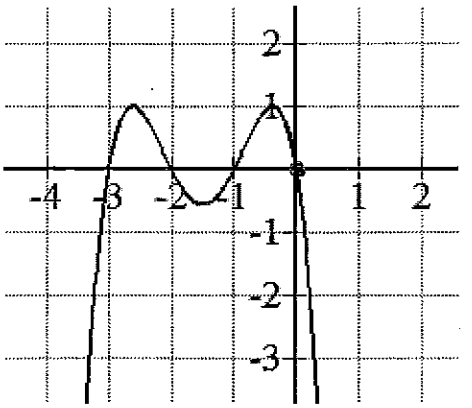
$y = a(x+4)(x-2)(x-6)$
$y = \frac{1}{4}(x+4)(x-2)(x-6)$
$y = 1/4(x+4)(x^2-8x+12)$
$y = 1/4(x^3-8x^2+12x$
$4x^2-32x+48)$
$y = 1/4(x^3-4x^2-20x+48)$
$y = \frac{1}{4}x^3-x^2-5x+12$

18. $-6 = a(3)(2)(1)$
$-6 = 6a$
$a = -1$



$y = a(x+3)(x+2)(x+1)$
$y = -1(x+3)(x+2)(x+1)$
$y = -1(x+3)(x^2+3x+2)$
$y = -1(x^3+3x^2+2x$
$3x^2+9x+6)$
$y = -1(x^3+6x^2+11x+6)$
$y = -x^3-6x^2-11x-6$

19. $a = -1$



$y = a(x+3)(x+2)(x+1)(x)$
$y = -1(x+3)(x+2)(x+1)(x)$
$y = -1(x^2+5x+6)(x^2+x)$
$y = -1(x^4+x^3$
$+5x^3+5x^2$
$6x^2+6x)$
$y = -1(x^4+6x^3+11x^2+6x)$
$y = -1x^4-6x^3-11x^2-6x$

State the degree of the polynomial. Describe the end behavior of the graph of the polynomial function WITHOUT graphing.

20. $f(x) = 4x - 2 + 5x^5$
degree 5 odd L.C. (+)
$x \to -\infty$ $f(x) \to -\infty$
$x \to \infty$ $f(x) \to \infty$

21. $f(x) = -5x^3$ odd L.C. (−)
degree 3
$x \to -\infty$ $f(x) \to \infty$
$x \to \infty$ $f(x) \to -\infty$

22. $f(x) = -12x^6 - 2x + 5$ even L.C. (−)
degree 6
$x \to -\infty$ $f(x) \to -\infty$
$x \to \infty$ $f(x) \to -\infty$

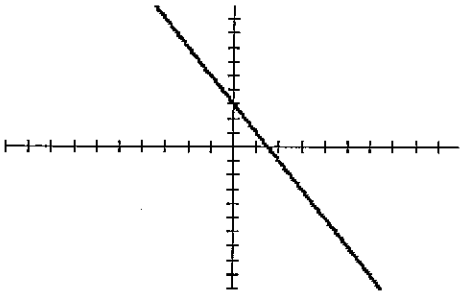
23. $f(x) = 5x^4 + 4x^2 - 2x + 6$ even L.C. (+)
degree 4
$x \to -\infty$ $f(x) \to \infty$
$x \to \infty$ $f(x) \to \infty$

24. $f(x) = 2x^5 - 7x^2 - 4x$
degree 5 odd L.C. (+)
$x \to -\infty$ $f(x) \to -\infty$
$x \to \infty$ $f(x) \to \infty$

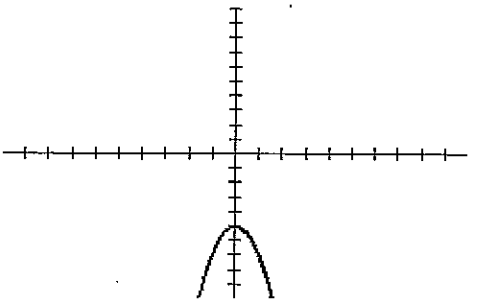
25. $f(x) = 4 - 2x + 3x^2 + 6x^4$ even L.C. (+)
degree 4
$x \to -\infty$ $f(x) \to \infty$
$x \to \infty$ $f(x) \to \infty$

Match the polynomial function with its graph WITHOUT using a graphing calculator.

A



B



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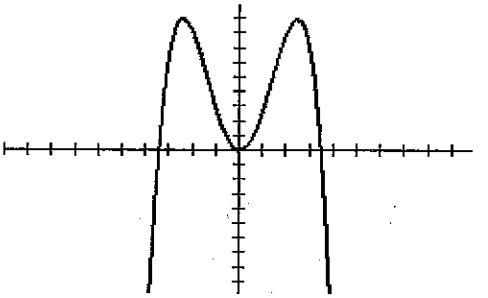

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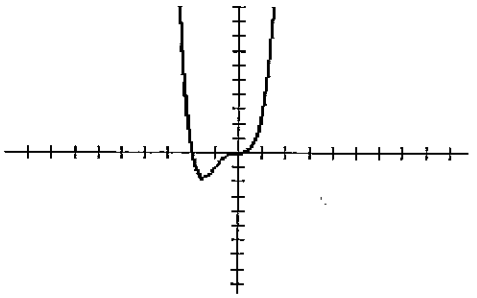

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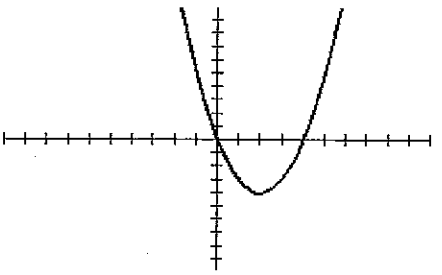

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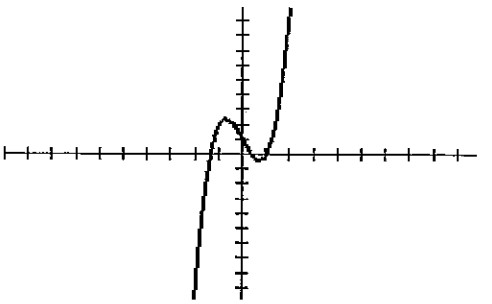
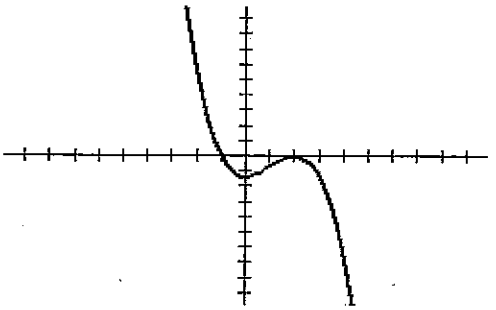
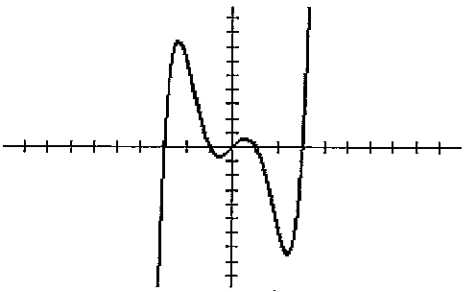


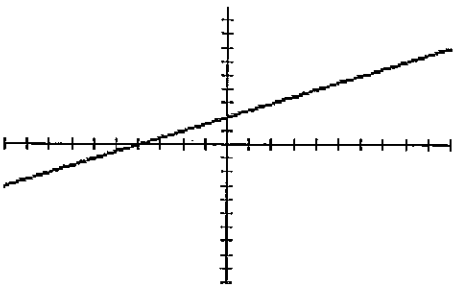
G



H



I



E 26. $f(x) = x^2 - 4x$

I 27. $f(x) = \frac{1}{2}x + 2$

A 28. $f(x) = -2x + 3$

F 29. $f(x) = 2x^3 - 3x + 1$

B 30. $f(x) = -2x^2 - 5$

D 31. $f(x) = x^4 + 2x^3$

G 32. $f(x) = -\frac{1}{3}x^3 + x^2 - \frac{4}{3}$

C 33. $f(x) = -\frac{1}{4}x^4 + 3x^2$

H 34. $f(x) = \frac{1}{5}x^5 - 2x^3 + \frac{9}{5}$