

PLEASE SHOW ALL WORK!!!!

1. Find the standard form for the polynomial function: $f(x) = (x-3)(x+4)(x+5)$

$$\begin{aligned} & (x^2+9x+20)(x-3) \\ & x^3+9x^2+20x-3x^2-27x-60 \\ y &= x^3+6x^2-7x-60 \end{aligned}$$

2. Given the polynomial function: $f(x) = x^3 + 3x^2 - 6x - 8$, with one factor $(x-2)$, find factored form using synthetic division:

$$\begin{array}{r|rrrr} 2 & 1 & 3 & -6 & -8 \\ & & 2 & 10 & 8 \\ \hline & 1 & 5 & 4 & 0 \end{array}$$

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

3. Given the polynomial function, $f(x) = x^3 + 3x^2 + 12x + 8$: why is 6 **not** a zero?

$$\frac{P}{Q} = \frac{8}{1} = \frac{1, 2, 4, 8}{1} \quad x = (\pm) 1, 2, 4, 8$$

By the Rational Roots Theorem, 6 cannot be a root

4. Use synthetic division to divide the polynomial $f(x) = x^3 + 3x^2 - 7x - 12$ by $(x+4)$

$$\begin{array}{r|rrrr} -4 & 1 & 3 & -7 & -12 \\ & & -4 & 4 & 12 \\ \hline & 1 & -1 & -3 & 0 \end{array}$$

$$x = \frac{-b \pm \sqrt{(b)^2 - 4(a)(c)}}{2a}$$

$$\begin{aligned} x &= \frac{1 \pm \sqrt{1 - 4(1)(-3)}}{2} \\ &= \frac{1 \pm \sqrt{13}}{2} \end{aligned}$$

$$y = (x+4)(2x - (1+\sqrt{13}))(2x - (1-\sqrt{13}))$$

5. Simplify to best form of answer: $(2+3i) + (4-5i)$

$$= 6 - 2i$$

6. Simplify to best form of answer: $(-3-2i)(-4+6i)$

$$\begin{aligned} & 12 - 18i + 8i - 12i^2 \\ & 12 - 10i - 12(-1) = 24 - 10i \end{aligned}$$

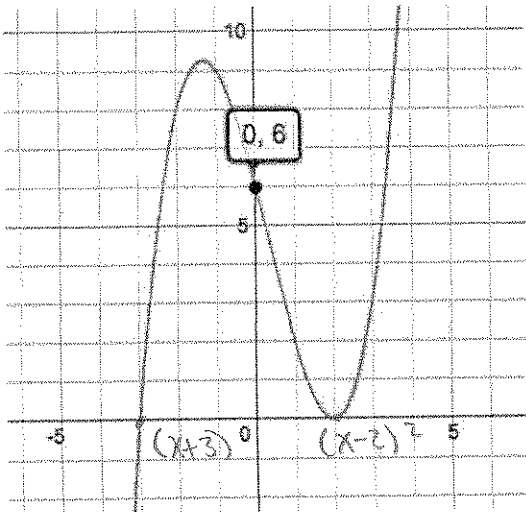
7. Simplify to best form of answer: $(5-8i) - (9+6i)$

$$= -4 - 14i$$

8. Simplify to best form of answer: i^{54}

$$\begin{array}{r} 13 \\ 4 \overline{) 54} \\ \underline{16} \\ 14 \end{array} \quad i^{54} = i^2 = -1$$

9. Write the equation for the graph:



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

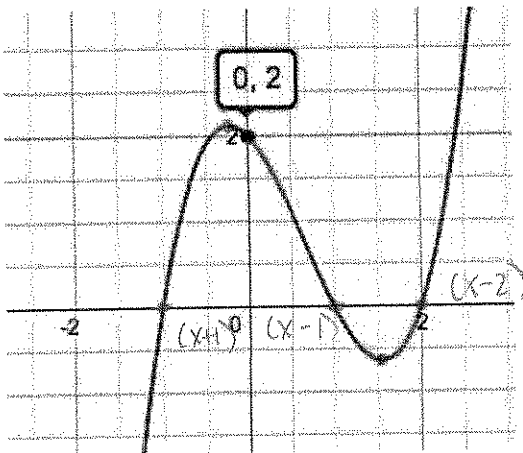
$$6 = a(3)(-2)^2$$

$$6 = 12a$$

$$a = 1/2$$

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

10. Write the equation for the graph:



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

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

$$2 = 2a$$

$$a = 1$$

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

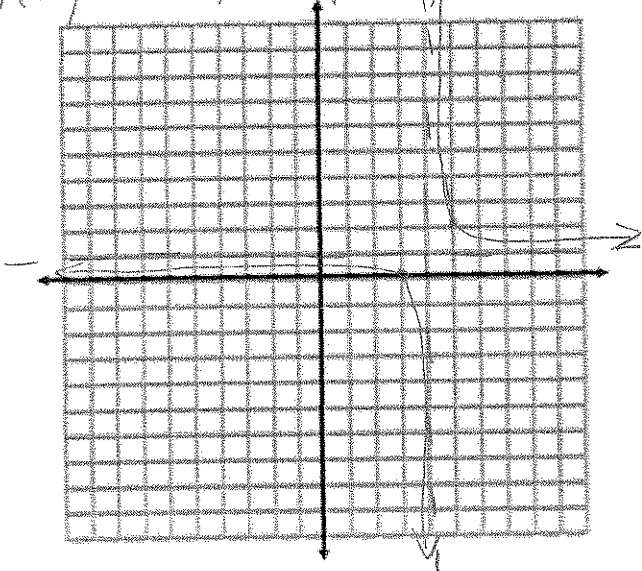
11. Graph the function $f(x) = \frac{1}{x-4} + 1$

VA: $x = 4$

X-int: $x = 3$

HA: $y = 1$

Y-int: $y = 3/4$



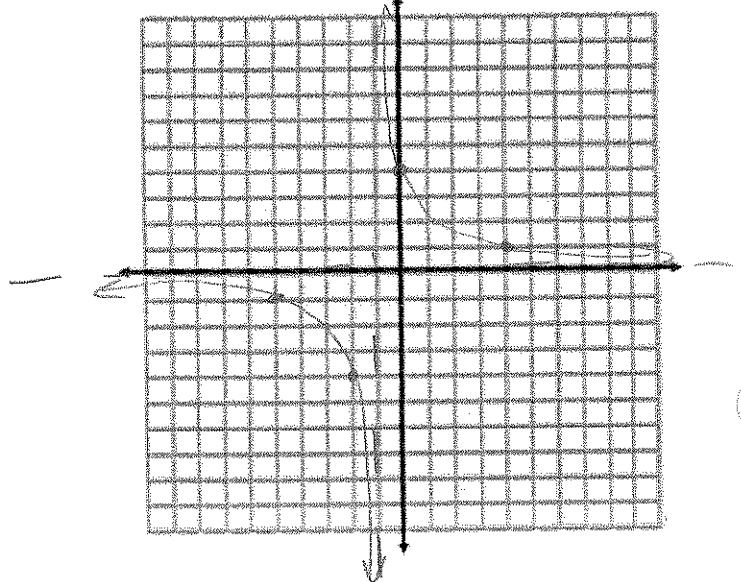
12. Graph the function $f(x) = \frac{4}{x+1}$

VA: $x = -1$

X-int: none

HA: $y = 0$

Y-int: $y = 4$



For problems 13-18 use the following functions:

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

$$g(x) = 2x - 5$$

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

$$k(x) = x^2 + 2x - 4$$

13. Find $f(3)$

$$\begin{aligned} f(3) &= (3)^2 + 2(3) - 3 \\ &= 9 + 6 - 3 \\ &= 12 \end{aligned}$$

15. Find $k(h(3))$

$$\begin{aligned} h(3) &= 3(3) - 7 \\ &= 9 - 7 \\ &= 2 \end{aligned}$$

$$\begin{aligned} k(2) &= (2)^2 + 2(2) - 4 \\ &= 4 + 4 - 4 \\ &= 4 \end{aligned}$$

17. Find $(h-k)(-3)$

$$\begin{aligned} h(-3) &= 3(-3) - 7 \\ &= -9 - 7 = -16 \end{aligned}$$

$$\begin{aligned} k(-3) &= (-3)^2 + 2(-3) - 4 \\ &= 9 - 6 - 4 = -1 \end{aligned}$$

$$-16 - (-1) = \boxed{-15}$$

14. Find x when $g(x) = 21$

$$21 = 2x - 5$$

$$26 = 2x$$

$$x = 13$$

16. Find $h(k(-4))$

$$\begin{aligned} k(-4) &= (-4)^2 + 2(-4) - 4 \\ &= 16 - 8 - 4 \\ &= 4 \end{aligned}$$

$$\begin{aligned} h(4) &= 3(4) - 7 \\ &= 12 - 7 \\ &= 5 \end{aligned}$$

18. Find $(hk)(5)$

$$\begin{aligned} h(5) &= 3(5) - 7 \\ &= 15 - 7 = 8 \end{aligned}$$

$$\begin{aligned} k(5) &= (5)^2 + 2(5) - 4 \\ &= 25 + 10 - 4 \\ &= 31 \end{aligned}$$

$$(31)(8) = 248$$

19. Find the inverse of the function $f(x) = \frac{3}{5}x + 15$

$$x = \frac{3}{5}y + 15 \quad 5x - 75 = 3y$$

$$x - 15 = \frac{3}{5}y \quad \rightarrow \quad \boxed{\frac{5}{3}x - 25 = f^{-1}(x)}$$

20. Find the inverse of the function $g(x) = 2x - 6$

$$x = 2y - 6$$

$$x + 6 = 2y$$

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

21. Given the following equation, describe its end behavior $f(x) = x^3 - 2x^2 - 4x + 1$

	+	-
even	↑↑	↓↓
odd	↓↑	↑↓

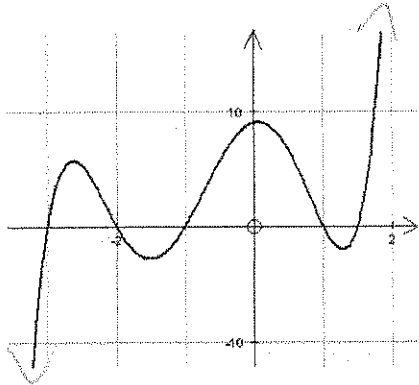
Since the degree is odd and the leading coefficient is positive, the graph will look like

↓↑

22. For the following function, find the roots $y = x(x+1)(x-5)$

Roots: 0, -1, 5

23. Describe the end behavior of the following graph:



	+	-
even	↑↑	↓↓
odd	↓↑	↑↓

Odd degree, positive leading coefficient

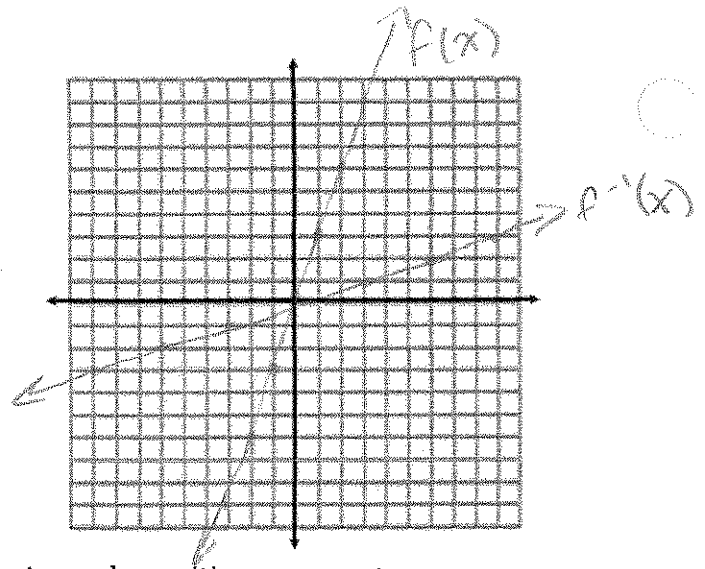
24. For the following function, find the roots and state the multiplicities of each $y = x^3(x-9)(x+1)^2$

Roots: 0 mult. 3, 9 mult. 1, -1 mult. 2

25. Graph the function and its inverse $f(x) = 3x$

$$x = 3y$$

$$\frac{1}{3}x = y$$



26. Simplify the following expression. Write the answer using only positive exponents.

$$(5x^{-6})(-2x^3) = -10x^{-3} = \frac{-10}{x^3}$$

27. Simplify the following expression. Write the answer using only positive exponents.

$$\left(\frac{4x^4}{2x^3}\right)^3 = \frac{64x^{12}}{8x^9} = 8x^3 \quad \text{or} \quad (2x)^3 = 8x^3$$

28. Solve: $\sqrt[3]{x^2} - 7 = 56$

$$\sqrt[3]{x^2} = 63$$

$$x = 500.047$$

29. Solve: $\sqrt[3]{4x+1} - 20 = 7$

$$\sqrt[3]{4x+1} = 27$$

$$4x+1 = 19683$$

$$4x = 19682$$

$$x = 4920.5$$

30. Solve: $9^{(x-4)} = 27^{2x}$

$$2x-8 = 6x$$

$$-8 = 4x$$

$$x = -2$$

