

$$1. \frac{x^3}{y^7} = \frac{1}{x^4}$$

$$2. \frac{x^{12}y^3}{x^4y^6} = \frac{x^8}{y^3}$$

$$3. (2x^4)^{-3} = \frac{1}{8x^{12}}$$

$$4. x^3 - 2x^2 - 15x = x(x^2 - 2x - 15) \\ = \underline{x(x-5)(x+3)}$$

$$5. a^3 - 2a^2 - 9a + 18 \\ a^2(a-2) - 9(a-2) \\ (a^2-9)(a-2) \\ \underline{(a+3)(a-3)(a-2)}$$

$$6. \begin{array}{l} 2x^2 + 9x - 5b \\ 2x^2 + 16x - 7x - 5b \\ 2x(x+8) - 7(x+8) \\ \underline{(2x-7)(x+8)} \end{array} \quad \begin{array}{l} 2(-5b) = -112 \\ 16-7 = 9 \end{array}$$

$$7. \underline{x \neq 2 \quad x \neq -7}$$

$$8. \mathbb{R}$$

$$9. \underline{x \geq 7}$$

10. not a function; x-axis, y-axis and origin symmetry

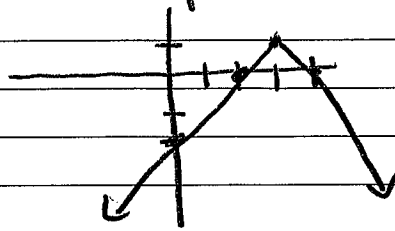
11. function, origin symmetry

12. function; y-axis symmetry

$$15. \begin{array}{l} y - y_1 = m(x - x_1) \\ (y - 5) = \frac{2}{3}(x - 3) \\ y - 5 = \frac{2}{3}x - 2 \\ \underline{y = \frac{2}{3}x + 3} \end{array} \quad // \text{slope} = \frac{2}{3}$$

23. Reflection over x-axis

Right 3, up 1



$$f(0) = -|0-3| + 1$$

$$= -3 + 1$$

$$= -2$$

$$0 = -|x-3| + 1$$

$$-1 = -|x-3|$$

$$1 = |x-3|$$

$$-1 = x-3 \quad 1 = x-3$$

$$2 = x \quad 4 = x$$

$$(2, 0) \quad (4, 0)$$

24. $(x^2 + 6x + 3^2) = 7 + 9$

$$(x+3)^2 = 16$$

$$\boxed{(x+3)^2 - 16 = 0}$$

25. $(x^2 + 8x + 4^2) + 25 - 16 = 0$

$$\boxed{(x+4)^2 + 9 = 0}$$

26. $(3 - 2i) + (5 + 7i)$

$$\boxed{8 + 5i}$$

27. $(8 - 3i)(4 - i)$

$$32 - 8i - 12i + 3i^2$$

$$32 - 20i - 3$$

$$\boxed{29 - 20i}$$

28.

$$\frac{1}{3-2i} \cdot \frac{3+2i}{3+2i} = \frac{3+2i}{9-4i^2}$$

$$= \boxed{\frac{3+2i}{13}}$$

29. $i^{35} = i^3$

$$\boxed{-i}$$

$$\frac{35}{4} = 8 \text{ R. } 3$$

$$38. 4x + 2 > 6x - 6$$

$$-2x > -8$$

$$x < 4$$

$$\boxed{(-\infty, 4)}$$

$$39. 5x \leq 15 \text{ or } x + 6 > 13$$

$$x \leq 3$$

$$x > 7$$

$$\boxed{(-\infty, 3] \text{ or } (7, \infty)}$$

$$40. |2x + 1| < 9$$

$$2x + 1 < 9$$

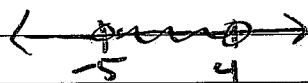
$$2x < 8$$

$$x < 4$$

$$2x + 1 > -9$$

$$2x > -10$$

$$x > -5$$



$$\boxed{(-5, 4)}$$

$$1. \frac{x^3}{y^7} = \frac{1}{x^4}$$

$$2. \frac{x^{12}y^3}{x^4y^6} = \frac{x^8}{y^3}$$

$$3. (2x^4)^{-3} = \frac{1}{8x^{12}}$$

$$4. x^3 - 2x^2 - 15x = x(x^2 - 2x - 15) \\ = x(x-5)(x+3)$$

$$5. a^3 - 2a^2 - 9a + 18 \\ a^2(a-2) - 9(a-2) \\ (a^2-9)(a-2) \\ (a+3)(a-3)(a-2)$$

$$6. \begin{array}{l} 2x^2 + 9x - 5b \\ 2x^2 + 16x - 7x - 5b \\ 2x(x+8) - 7(x+8) \\ (2x-7)(x+8) \end{array} \quad \begin{array}{l} 2(-5b) = -112 \\ 16-7 = 9 \end{array}$$

$$7. x \neq 2 \quad x \neq -7$$

$$8. \mathbb{R}$$

$$9. x \geq 7$$

10. not a function; x-axis, y-axis and origin symmetry

11. function, origin symmetry

12. function; y-axis symmetry

$$15. y - y_1 = m(x - x_1) \quad // \text{ slope} = \frac{2}{3} \\ (y - 5) = \frac{2}{3}(x - 3) \\ y - 5 = \frac{2}{3}x - 2 \\ y = \frac{2}{3}x + 3$$

16. \perp slope = $\frac{2}{5}$ through (6, 5)

$$y - 5 = \frac{2}{5}(x - 6)$$
$$y - 5 = \frac{2}{5}x - \frac{12}{5}$$
$$y = \frac{2}{5}x - \frac{12}{5} + 5$$
$$y = \frac{2}{5}x - \frac{12}{5} + \frac{25}{5}$$
$$y = \frac{2}{5}x + \frac{13}{5}$$

13. slope = $\frac{1}{2}$ y-intercept (0, 3)

$$2y = -3x + 8$$
$$y = -\frac{3}{2}x + 4$$

slope = $-\frac{3}{2}$

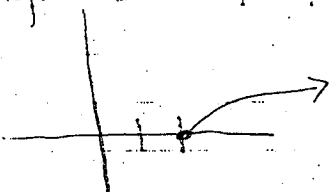
y-int (0, 4)

17. even

18. neither

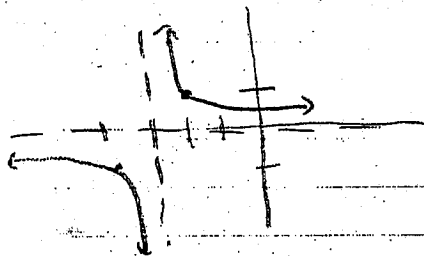
19. odd

20. Right 2 D: $x \geq 2$

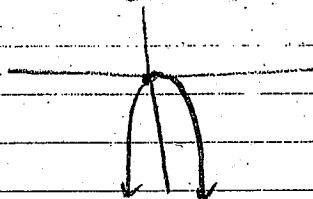


21. left 3 $x \neq -3$

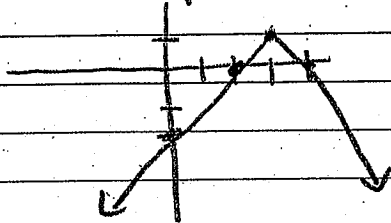
$$f(0) = \frac{1}{3}$$



22. Reflection over x-axis
Vertical stretch of 3



23. Reflection over x-axis
Right 3, up 1



$$\begin{aligned} f(0) &= -|0-3| + 1 \\ &= -3 + 1 \\ &= -2 \end{aligned}$$

$$\begin{aligned} 0 &= -|x-3| + 1 \\ -1 &= -|x-3| \\ 1 &= |x-3| \\ -1 &= x-3 & 1 &= x-3 \\ 2 &= x & 4 &= x \\ (2, 0) & & (4, 0) & \end{aligned}$$

$$\begin{aligned} 24. (x^2 + 6x + 3^2) &= 7 + 9 \\ (x+3)^2 &= 16 \\ \boxed{(x+3)^2 - 16} &= 0 \end{aligned}$$

$$\begin{aligned} 25. (x^2 + 8x + 4^2) + 25 - 16 &= 0 \\ \boxed{(x+4)^2 + 9} &= 0 \end{aligned}$$

$$\begin{aligned} 26. (3 - 2i) + (5 + 7i) \\ \boxed{8 + 5i} \end{aligned}$$

$$\begin{aligned} 27. (8 - 3i)(4 - i) \\ 32 - 8i - 12i + 3i^2 \\ 32 - 20i - 3 \\ \boxed{29 - 20i} \end{aligned}$$

$$\begin{aligned} 28. \frac{1}{3-2i} \cdot \frac{3+2i}{3+2i} &= \frac{3+2i}{9-4i^2} \\ &= \boxed{\frac{3+2i}{13}} \end{aligned}$$

$$\begin{aligned} 29. i^{35} &= i^3 \\ &= \boxed{-i} \end{aligned} \quad \frac{35}{4} = 8 \text{ R. } 3$$

$$30. \frac{x}{x+2} - \left(\frac{x+5}{x+5} \right) - \frac{3}{x+5} \left(\frac{x+2}{x+2} \right)$$

$$\frac{x^2 + 5x - 3x - 6}{x^2 + 5x + 2x + 10}$$

$$\boxed{\frac{x^2 + 2x - 6}{x^2 + 7x + 10} \quad x \neq -5, -2}$$

$$31. (x-3)^2 = \boxed{x^2 - 6x + 9}$$

$$32. \sqrt{20x^3y^6} = \sqrt{20 \cdot (x^3)^{\frac{1}{2}} \cdot (y^6)^{\frac{1}{2}}}$$

$$2\sqrt{5} \cdot x^{\frac{3}{2}} \cdot y^3$$

$$\boxed{2x^{\frac{3}{2}}y^3\sqrt{5}}$$

$$33. \sqrt{-20} = \boxed{2i\sqrt{5}}$$

$$34. \frac{\sqrt{3}}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \boxed{\frac{\sqrt{15}}{5}}$$

$$35. \sqrt{x+3} - 5 = 1$$

$$\sqrt{x+3} = 6$$

$$x+3 = 36$$

$$\boxed{x = 33}$$

$$36. x^4 + 7x^2 + 10 = 0$$

$$(x^2 + 5)(x^2 + 2) = 0$$

$$x^2 + 5 = 0$$

$$x^2 = -5$$

$$\boxed{x = \pm i\sqrt{5}}$$

$$x^2 + 2 = 0$$

$$x^2 = -2$$

$$\boxed{x = \pm i\sqrt{2}}$$

$$37. x^2 - 17x - 5 = 0$$

$$17 \pm \frac{\sqrt{(-17)^2 - 4(1)(-5)}}{2(1)}$$

$$\frac{17 \pm \sqrt{289 + 20}}{2}$$

$$\boxed{\frac{17 \pm \sqrt{309}}{2}}$$

$$38. 4x + 2 > 6x - 6$$

$$-2x > -8$$

$$x < 4$$

$$\boxed{(-\infty, 4)}$$

$$39. 5x \leq 15 \text{ or } x + 6 > 13$$

$$x \leq 3$$

$$x > 7$$

$$\boxed{(-\infty, 3] \text{ or } (7, \infty)}$$

$$40. |2x + 1| < 9$$

$$2x + 1 < 9$$

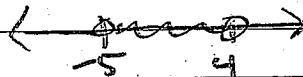
$$2x + 1 > -9$$

$$2x < 8$$

$$2x > -10$$

$$x < 4$$

$$x > -5$$



$$\boxed{(-5, 4)}$$

$$41. \quad f(x) = x^2 + 6$$

$$f(-4) = (-4)^2 + 6$$

$$= 16 + 6$$

$$= 22$$

$$\boxed{f(-4) = 22}$$

$$42. \quad (g \circ f)(x) = g(f(x)) = g(x^2 + 6)$$

$$g(x) = 3x - 4$$

$$g(x^2 + 6) = 3(x^2 + 6) - 4$$

$$= 3x^2 + 18 - 4$$

$$\boxed{g(f(x)) = 3x^2 + 14}$$

$$43. \quad (f+g)(-1) = f(-1) + g(-1)$$

$$f(-1) = (-1)^2 + 6 \quad 7 + -7$$

$$= 1 + 6 \quad \underline{0}$$

$$g(-1) = 3(-1) - 4 \quad \boxed{(f+g)(-1) = 0}$$

$$= -3 - 4$$

$$= -7$$

$$(f+g)(x) =$$

$$f(x) + g(x)$$

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

$$= x^2 + 3x + 2$$

$$(f+g)(-1) = (-1)^2 + 3(-1) + 2$$

$$= 1 - 3 + 2$$

$$\boxed{(f+g)(-1) = 0}$$

$$44. \quad 3x^2 + 2x(-7) = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{(2)^2 - 4(3)(-7)}}{2(3)}$$

$$x = \frac{-2 \pm \sqrt{4 + 84}}{6}$$

$$x = \frac{-2 \pm \sqrt{88}}{6}$$

$$x = \frac{-2 \pm \sqrt{4} \sqrt{22}}{6}$$

$$x = \frac{-2 \pm 2\sqrt{22}}{6} = \boxed{\frac{1 \pm \sqrt{22}}{3}}$$

$$\begin{aligned}
 45. \quad x^2 + 25 &= 0 \\
 x^2 &= -25 \\
 x &= \pm \sqrt{-25} \\
 x &= \pm 5i
 \end{aligned}$$

$$\begin{aligned}
 46. \quad |x-1| &= 4 \\
 x-1 &= -4 \quad \text{or} \quad x-1 = 4 \\
 x &= -3 \quad \text{or} \quad x = 5
 \end{aligned}$$

$$\begin{aligned}
 47. \quad |x-1| + 3 &= 6 \\
 |x-1| &= 3 \\
 x-1 &= -3 \quad \text{or} \quad x-1 = 3 \\
 x &= -2 \quad \text{or} \quad x = 4
 \end{aligned}$$

$$\begin{aligned}
 48. \quad \frac{1}{3} - \frac{1}{x} &= \frac{5}{6} \\
 6x \left(\frac{1}{3} - \frac{1}{x} = \frac{5}{6} \right) & \quad \text{LCD} \\
 \frac{6x}{3} - \frac{6x}{x} &= \frac{30x}{6} \\
 2x - 6 &= 5x \\
 -6 &= 3x \\
 -2 &= x
 \end{aligned}$$

$$\begin{aligned}
 49. \quad \frac{3x}{x+2} + \frac{6}{x} &= \frac{12}{x^2+2x} \\
 x(x+2) \left(\frac{3x}{x+2} + \frac{6}{x} = \frac{12}{x(x+2)} \right) & \quad \text{LCD} \\
 \frac{3x(x+2)}{x+2} + \frac{6(x+2)}{x} &= \frac{12x(x+2)}{x(x+2)} \\
 3x + 6(x+2) &= 12 \\
 3x + 6x + 12 &= 12 \\
 9x &= 0 \\
 x &= 0
 \end{aligned}$$

$$\begin{aligned}
 50. \quad y &= -(x+3)^2 + 4 \\
 \text{Vertex} &= (-3, 4) \\
 \text{Axis: } x &= -3
 \end{aligned}$$

50. $y = (-x+3)^2 + 4$
 Vertex $(-3, 4)$
 Axis: $x = -3$

x-intercepts
 $0 = -(x+3)^2 + 4$
 $0 = -(x^2 + 6x + 9) + 4$
 $0 = -x^2 - 6x - 9 + 4$
 $0 = -x^2 - 6x - 5$
 $0 = x^2 + 6x + 5$
 $0 = (x+3)(x+2)$
 $x = -3 \quad x = -2$

51. $f(x) = 2x^2 - 20x + 14$ x-ints: $(-3, 0)$ $(-2, 0)$

$x = \frac{-b}{2a} = \frac{-(-20)}{2(2)} = \frac{20}{4} = 5$
 $f(5) = 2(5)^2 - 20(5) + 14$
 $2 \cdot 25 - 100 + 14$
 $-50 + 14$

$f(5) = -36$

Vertex $(5, -36)$
 Axis $x = 5$

x-int

$0 = 2x^2 - 20x + 14$
 $0 = x^2 - 10x + 7$

$x = \frac{10 \pm \sqrt{10^2 - 4(1)(7)}}{2}$

$x = \frac{10 \pm \sqrt{100 - 28}}{2} = \frac{10 \pm \sqrt{72}}{2}$

$x = \frac{10 \pm 6\sqrt{2}}{2} = 5 \pm 3\sqrt{2}$

$(5+3\sqrt{2}, 0)$ $(5-3\sqrt{2}, 0)$

52. $x^2 + 10x + 14 \overline{) x^4 + 2x^3 + 0x^2 + 9x + 36}$
 $-(x^4 + 10x^3 + 4x^2)$
 $2x^3 - 4x^2 + 9x$
 $-(2x^3 + 10x^2 + 8x)$
 $-4x^2 + x + 36$
 $-(-4x^2 + 10x - 16)$

$x^2 + 2x - 4 + \frac{x+52}{x^2+4}$

$x + 52$

53. $(2y^3 - 5y^2 + 17) \div (y - 3)$

$$\begin{array}{r|rrrrr} 3 & 2 & -5 & 0 & 17 & \\ & & 6 & 3 & 9 & \\ \hline & 2 & 1 & 3 & 26 & \end{array}$$

$$\boxed{2y^2 + y + 3 + \frac{26}{y+3}}$$

54. $P(x) = 2x^4 + 3x^3 - 8x^2 - 9x + 6$

factors of 6 = $\pm 1 \pm 2 \pm 3 \pm 6$
 factors of 2 = $\pm 1 \pm 2$ = $\boxed{\pm 1 \pm 2 \pm 3 \pm 6 \pm \frac{1}{2} \pm \frac{3}{2}}$

55. zeros 3, $-2 + 3i$, $\sqrt{3}$

other zeros: $\boxed{-2 - 3i, -\sqrt{3}}$

56. $P(x) = x^3 - 6x^2 + 3x + 10$

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

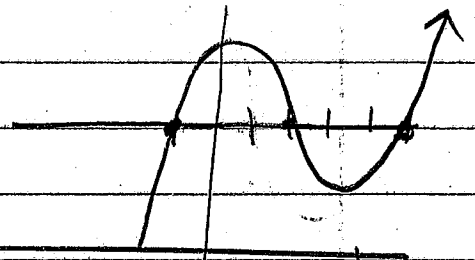
use calculator

$$x^2 - 4x - 5$$

$$(x - 5)(x + 1)$$

$x = 5$ $x = -1$

$\boxed{\text{zeros: } 2, 5, -1}$



57. $P(x) = x^3 - 8x^2 + 16x - 8$

use calc:

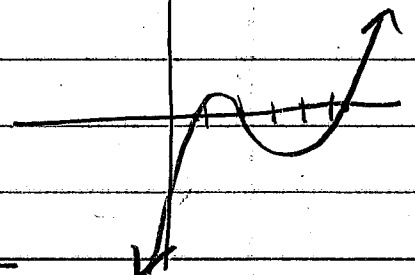
$$\begin{array}{r|rrrr} 2 & 1 & -8 & 16 & -8 \\ & & 2 & -12 & 8 \\ \hline & 1 & -6 & 4 & 0 \end{array}$$

$$x^2 - 6x + 4 = 0$$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(4)}}{2(1)} = \frac{6 \pm \sqrt{36 - 16}}{2} = \frac{6 \pm \sqrt{20}}{2} = \frac{6 \pm 2\sqrt{5}}{2} = 3 \pm \sqrt{5}$$

Exact zeros

zeros $\boxed{2, 3 \pm \sqrt{5}}$



58. $y = \frac{3}{3-x}$ Dom: $3-x \neq 0$ $(-\infty, 3) \cup (3, \infty)$
 $3 \neq x$
 Range: $(-\infty, 0) \cup (0, \infty)$

VA: $x=3$ HA: $y=0$ X-int: NONE

59. $y = \frac{8}{x^2-4}$ Domain: $x^2-4 \neq 0$ $(-\infty, -2) \cup (-2, 2) \cup (2, \infty)$
 $x^2 \neq 4$
 $x \neq 2, x \neq -2$
 Range: $(-\infty, 0) \cup (0, \infty)$

VA: $x=2, x=-2$ HA: $y=0$ X-int: NONE

60-62 DO NOT DO

63. $f(x) = 2x - 1$
 $y = 2x - 1$
 $x = \frac{y+1}{2}$
 $\frac{x+1}{2} = \frac{2y}{2}$
 $y = \frac{x+1}{2}$
 $f^{-1}(x) = \frac{x+1}{2}$

64. $f(x) = x^3 - 1$
 $y = x^3 - 1$
 $x = \sqrt[3]{y+1}$
 $x+1 = y^3$
 $\sqrt[3]{x+1} = y$
 $f^{-1}(x) = \sqrt[3]{x+1}$

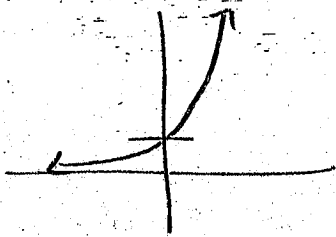
65. $5^3 = 125$
 $\log_5 125 = 3$

66. $p^k = 3$
 $\log_p 3 = k$

67. $\log_{10} 1000 = 3$
 $10^3 = 1000$

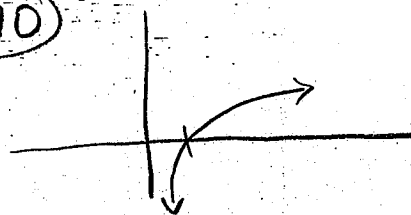
68. $\log_a M = -x$
 $a^{-x} = M$

69.



D: \mathbb{R}
R: $(0, \infty)$

70



D: $(0, \infty)$
R: \mathbb{R}

71

$$9^{\frac{1}{2}} = x$$

$$\boxed{3 = x}$$

72

$$3^x = 27$$

$$3^x = 3^3$$

$$\boxed{x = 3}$$

73

$$4^2 = 2x + 3$$

$$16 = 2x + 3$$

$$13 = 2x$$

$$\boxed{6.5 = x}$$

74

$$3^{x+3} = 3^4$$

$$x+3 = 4$$

$$\boxed{x = 1}$$

75

$$2.8^x = 61$$

$$\log_{2.8} 61 = x$$

$$\frac{\log 61}{\log 2.8} = \boxed{3.993}$$

76

$$e^t = 150$$

$$t \ln e = \ln 150$$

$$t = \ln 150$$

$$\boxed{t = 5.011}$$

77

$$\boxed{\log_3 \frac{xy^3}{z^4}}$$

78

$$\ln(x^4 y^2)^{\frac{1}{3}} - \ln z^3$$

$$\ln x^{\frac{4}{3}} + \ln y^{\frac{2}{3}} - \ln z^3$$

$$\boxed{\frac{4}{3} \ln x + \frac{2}{3} \ln y - 3 \ln z}$$

79

$$2 = e^{62k}$$

$$\frac{\ln 2}{62} = \frac{62k \ln e}{62}$$

$$.0111798 = k$$

$$\boxed{1.118\% = k}$$