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#42, 43, 45, 47, 49, 59, 61-66

42. $g(x)$ is discontinuous at $x = 1$.
Infinite discontinuity
$\lim_{x \to \infty} f(x) = -2$, $\lim_{x \to -\infty} = -2$

43. $h(x)$ is discontinuous at $x = 0$
Infinite discontinuity.
$\lim_{x \to \infty} f(x) = 0$, $\lim_{x \to -\infty} f(x) = 0$

45. Not continuous. Infinite discontinuity.
$\lim_{x \to \infty} f(x) = 0$, $\lim_{x \to -\infty} f(x) = 0$

x-intercepts: $0 = \frac{x^2}{x^3 - 4x^2 + x + 6}$
$0 = x^2$
$0 = x$

47. Not continuous. Infinite discontinuity
$\lim_{x \to \infty} f(x) = 4$, $\lim_{x \to -\infty} = 4$

$0 = \frac{4x^2 + 11x - 3}{x^2 + 3x - 18}$

| | $x$ | $3$ |
|---|---|---|
| $4x$ | $4x^2$ | $12x$ |
| $-1$ | $-1x$ | $-3$ |

$-12$

$12 + -1 = 11$

$0 = 4x^2 + 11x - 3$
$0 = (4x - 1)(x + 3)$
$x = \frac{1}{4}$ $x = -3$

49. Not continuous. Infinite discontinuity.
$\lim_{x \to \infty} h(x) = \infty$, $\lim_{x \to -\infty} h(x) = -\infty$

$0 = \frac{x^3 - 5x^2 - 26x + 120}{x^2 + x - 12}$

$0 = x^3 - 5x^2 - 26x + 120$ (graph and look for intercepts) $x = -5, 4, 6$

59. Infinite because $(0)^5 = 0$ and you can't have 0 in the denominator.

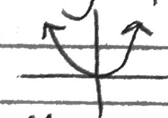
61. To be continuous x has to equal 3 for $x^2 + a$ and $bx + a$

$$(3)^2 + \cancel{a} = b(3) + \cancel{a}$$
$$9 = 3b$$
$$3 = b$$

To be continuous x has to equal -3 for $bx + a$ and $\sqrt{-b-x}$

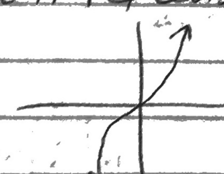
$$b(-3) + a = \sqrt{-b-(-3)}$$
$$b = 3 \qquad (3)(-3) + a = \sqrt{-(3)-(-3)}$$
$$-9 + a = \sqrt{0}$$
$$-9 + a = 0$$
$$a = 9$$

62. $\lim_{x \to -\infty} f(x) = -\infty$ even functions have same end behavior on both sides since they reflect across the y-axis ex)



63. $\lim_{x \to -\infty} f(x) = \infty$ odd functions have different end behavior because it reflects over the origin.

ex



64. $\lim_{x \to -\infty} f(x) = -\infty$ odd function, different end behavior

65. $\lim_{x \to -\infty} f(x) = \infty$ even function, same end behavior.

66. any function that has a cancellation has a removable discontinuity.
ex) $\frac{x(x+3)}{x+3}$ has a removeable discontinuity at $x = -3$

we can eliminate it by defining the function at that point

$$f(x) = \begin{cases} \frac{x(x+3)}{x+3} & x \neq -3 \\ -3 & x = -3 \end{cases}$$

| x | y |
|---|---|
| -5 | -5 |
| -4 | -4 |
| -3 | error |
| -2 | -2 |