1a) The domain of \( \frac{x+1}{x-2} \) is \(((-\infty, 2)) \cup (2, \infty)\)
and \(e^u\) is defined for all \(u\) so the domain is \(((-\infty, 2)) \cup (2, \infty)\).

b) \(x^2 + 4 \geq 4 > 0\) for all \(x\) so the domain is all real numbers, \((-\infty, \infty)\).

c) \(x^2 - 4\) must be positive. Looking at the graph, this is true on \((-\infty, -2)) \cup (2, \infty)\).

d) \(\ln(x-2)\) is defined for \(x > 2\), \(\ln(x+2)\) is defined for \(x > -2\). So both are defined for \(x > 2\) or on \((2, \infty)\).

Note: \(\ln(x^2 - 4) = \ln(x-2) + \ln(x+2)\) wherever both are defined, that is on \((2, \infty)\).

e) \(\sqrt{u}\) is defined for all \(u\) and \(x^2 - 25\) is defined for all \(x\) the domain is \((-\infty, \infty)\).
2. \( x = \# \text{ of pages copied. For } 0 \leq x \leq 100, \) 
\[ f(x) = 0.25 \times x \text{ dollars} \]
For \( x > 100, \)
\[ f(x) = 0.25(100) + 0.2(x-100) \]
\[ = 25 + 0.2x - 20 \]
\[ = 5 + 0.2x \text{ dollars} \]
\[ f(x) = \begin{cases} 
0.25x & 0 \leq x \leq 100 \\
5 + 0.2x & 100 < x 
\end{cases} \]

3. Since \( f(x) \) is a transformation of \( x^2 \) without an \( x \)-distortion, we know
\[ f(x) = a(x-h)^2 + k \text{ a } y \text{-distortion, possibly a reflection, a horiz. shift and a vertical shift.} \]
The vertex of the parabola is \((3,10)\) which is the transfig. of \((0,0)\).
\( h = 3 \) and \( k = 10 \)

Find \( a \): Plug in \((2,15)\) \((0,0)\)
\[ f(2) = a(2 - 3)^2 + 10 = a + 10 = 15 \]
so \( a = 5 \)

\[ f(x) = 5(x-3)^2 + 10 \]
4. a) The vertical asymptote of $y = \ln x$ is $x = 0$, which has been shifted to $x = -4$ so $C = 4$.

$$f(x) = A + B \ln(x + 4)$$

Plug in the given pts. to solve for $A$ and $B$:

$e^{-4} + 4 = e$ and $\ln e = \log_{e}e = 1$ so

$$f(e^{-4}) = A + B = 3$$

$e^{2} - 4 + 4 = e^{2}$ and $\ln e^{2} = 2$ so

$$f(e^{2} - 4) = A + 2B = 0$$

\[
\begin{align*}
A + 2B &= 0 \\
A + B &= 3 \\
B &= -3
\end{align*}
\]

Subtract $B = -3$ into $A + B = 3$ into $A + (-3) = 3$ so $A = 6$

$$f(x) = 6 - 3 \ln(x + 4)$$
4 b) \[ A = -2 \quad A + B e^{c \cdot 0} = -2 + B = 0 \]

\[ 13 = 2 \]

\[ f(x) = -2 + 2e^{cx} \]

\[ f(1) = -2 + 2e^c = -1 \]

\[ 2e^c = 1 \quad e^c = \frac{1}{2} \quad c = \ln\left(\frac{1}{2}\right) \]

\[ f(x) = -2 + 2e^{\frac{\ln(\frac{1}{2})}{x}} = -2 + 2e^{\ln(\frac{1}{2})^x} \]

5. a) \[ e^{-2x} = (e^{-x})^2 \]

so \[ f(g(x)) = (e^{-x})^2 + 5e^{-x} + 1 \]

\[ g(x) = e^{-x} \quad \text{and} \quad f(x) = x^2 + 5x + 1 \]

b) \[ g(x) = x^2 + 3 \quad \text{and} \quad f(x) = \ln x \]

6. a) \[ N(t) = 200 \left(1.5\right)^{t/3} \]

b) \[ (1.5)^{t/3} = e^{\ln(1.5)^{t/3}} = e^{t\ln(1.5)^{1/3}} \]

\[ N(t) = 200e^{\frac{t\ln(1.5)}{3}} \]
7. The quartic fits the given data a little better but turns downward past \( x=90 \). Since stamp prices will probably continue to rise, the exponential would be better for extrapolating.

8a) Swithing \( x \) and \( y \) and solving for \( y \):
\[
x = 5e^{3y} \quad \frac{x}{5} = e^{3y} \quad \ln \frac{x}{5} = 3y
\]
\[
y = \frac{1}{3} \ln \left( \frac{x}{5} \right) = \frac{1}{3} \ln x - \frac{1}{3} \ln 5 = f^{-1}(x)
\]

b) \( x = \ln(2y - 5) \)
\[
e^x = 2y - 5
\]
\[
f^{-1}(x) = \frac{1}{2} e^x + \frac{5}{2}
\]

9. a) \( x = e^{\ln(2^4)} = 2^4 = 16 \)

b) \( \sqrt[4]{x} = a \)
\[
x^{-\frac{1}{2}} = \frac{1}{2} \quad [x = -\frac{1}{2}]
\]

9) \( \log_2(x+3) = \log_2(x+4) = 3 \)
\[
\log_2 \left( \frac{x+3}{x+4} \right) = 3
\]
\[
\frac{x+3}{x+4} = 2^3 = 8
\]
\[
x+3 = 8x+32
\]
\[
-29 = 7x
\]
\[
-\frac{29}{7} = x \quad \text{so no solution}
We cannot plug \(-\frac{29}{7} + 3\) or \(-\frac{29}{7} + 4\) into \(\log_2\).

10. Find \(d(5)\) and \(d(2)\):

\[
d(5) = 16.2 - 2(25) = 11.2
\]
\[
d(2) = 16.2 - 2(4) = 15
\]

\[
\frac{d(5) - d(2)}{5 - 2} = \frac{11.2 - 15.4}{3} = \frac{-4.2}{3} = -1.4 \text{ ft/sec}
\]

is \(\text{Vavg}\).

Find \(v\) just at 2 sec:

\[
\frac{d(t) - d(2)}{t - 2} = \frac{16.2 - 2t^2 - 15.4}{t - 2} = \frac{8 - 2t^2}{t - 2}
\]

\[
= \frac{2(4 - t^2)}{t - 2} = \frac{2(2 - t)(2 + t)}{t - 2} = \frac{2 - t}{t - 2}
\]

\[
= -2(t + 2) \rightarrow t \rightarrow 2 = -2(2 + 2)
\]

\[-8 \text{ ft/sec}
\]

The negative means it is going left.

\[\text{The object has negative position, so it is} \]

\[\text{the start.}\]
11. a) Substitution of \( x = 1 \) gives \( \frac{0}{0} \).

Factoring, we have:
\[
\frac{2(x^2 + 2x - 3)}{(x-1)(x+1)} = \frac{2(x+3)(x-1)}{(x-1)(x+1)} = \frac{2(x+3)}{x+1} \quad \text{if} \; x \neq 1
\]
\[
\lim_{x \to 1} f(x) = \frac{2(1+3)}{1+1} = \frac{8}{2} = 4
\]

b) Since substituting \(-1\) gives \( \frac{\text{nonzero}}{0} \), the limit \( \boxed{\text{DNE}} \).

c) Substituting \( x = -3 \) gives \( \boxed{0} \).

12. a) First find \( \lim_{x \to 0} -\frac{1}{x} = -\infty \)

\[
\lim_{u \to -\infty} e^u = 0 \quad \text{so} \quad \lim_{x \to 0^-} e^{\frac{1}{x}} = 0
\]

b) \( \lim_{x \to 0^+} \frac{1}{x} = +\infty \) so \( \lim_{x \to 0^+} e^{\frac{1}{x}} = +\infty \)

\[
\frac{4x^5 - 15x^2}{2x^2 - 5} \sim \frac{4x^5}{2x^2} = 2x^3 \quad \text{as} \; x \to \infty
\]

\( \sim \) means "has the same limit as"

c) \( \frac{4x^5 - 15x^2}{2x^2 - 5} \sim \frac{4x^5}{2x^2} \) and \( 2x^3 \) is negative for \( x < 0 \)

\( \lim_{x \to -\infty} \)

\( \boxed{-\infty} \)

\( \boxed{-\infty} \)
12e) Both go to $\infty$ and $\infty - \infty$ is indeterminate. So conjugate:

\[
\frac{\sqrt{x^2-15x} - \sqrt{x^2+2x}}{\sqrt{x^2-15x} + \sqrt{x^2+2x}} = \frac{(x^2-15x)-(x^2+2x)}{\sqrt{x^2-15x} + \sqrt{x^2+2x}} = \frac{-17x}{\sqrt{x^2-15x} + \sqrt{x^2+2x}} \sim \frac{-17x}{2x} \rightarrow \frac{-17}{2}
\]

12f) \( \frac{\sqrt{x}+1}{-3\sqrt{x}+2} \sim \frac{\sqrt{x}}{-3\sqrt{x}} \rightarrow \frac{-1}{3} \)

13. a) \( f \) is continuous for all \( x \). No discontinuity.

\[ \lim_{x \to 0^-} f(x) = \lim_{x \to 0^-} e^{\frac{x}{x^2}} = 0 \text{ and } \sin 0 = 0 \]

\[ \text{and } \lim_{x \to 0^+} \sin x = 0 \]

b) \( x^2-1 = (x-1)(x+1) \). We need to check \( x = -1 \) and \( x = 1 \).

Factor numerator: \( 2(x^2+2x-3) = 2(x+3)(x-1) \)

\[ g(x) = \frac{2(x+3)(x-1)}{(x+1)(x-1)} = \frac{2(x+3)}{x+1} \text{ if } x < 1 \]

\[ \lim_{x \to -1} g(x) \text{ DNE and } g \text{ has a V.A. } x = -1 \]
\[
\lim_{x \to 1^-} g(x) = \frac{2(1+3)}{1+1} = 4
\]
\[
\lim_{x \to 1^+} g(x) = 4(1) = 4 = g(1)
\]
So the only discontinuity is at \(-1\).