1) *a) Domain of*:

$$f(x) = \sqrt{x^2 - 16}$$

$1)\ a)\ Domain\ of: \sqrt{g(x)} \rightarrow g(x) \geq 0$

$$f(x) = \sqrt{x^2 - 16}$$

$$x^2 - 16 \geq 0$$

$$x^2 \geq 16$$

$$\text{Domain} \begin{cases} x \leq -4 \\ x \geq 4 \end{cases}$$

1) *j) Domain of*:

$$f(x) = \ln(x + 2) + \ln(x - 2)$$

1) $j)$ *Domain of*: $\quad \ln(g(x) \rightarrow g(x) > 0$

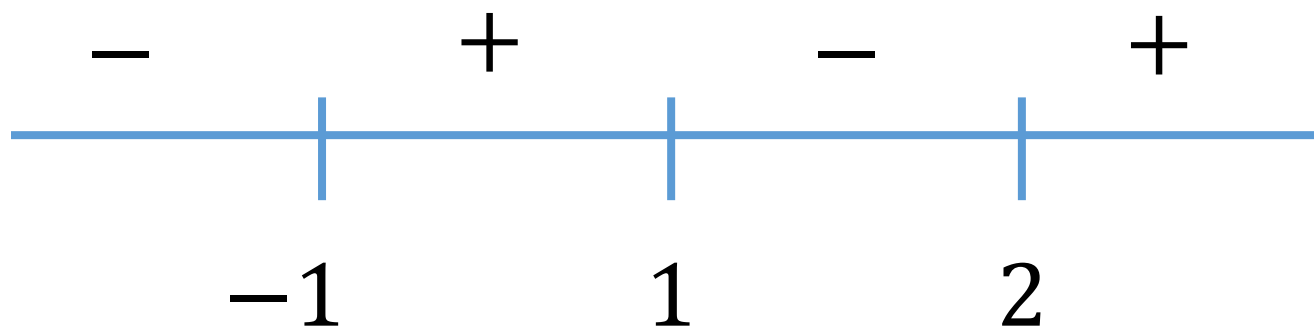$$f(x) = \ln(x + 2) + \ln(x - 2)$$

$$(x + 2) > 0, (x - 2) > 0$$

Domain $\begin{cases} x > -2 \\ x > 2 \end{cases} \rightarrow x > 2$

1) i) $Domain\ of$:

$$f(x) = \ln\left(\frac{x^2 - 3x + 2}{x + 1}\right)$$

1) i) *Domain of*: $\quad\ln(g(x) \rightarrow g(x) > 0$

$$f(x) = \ln\left(\frac{x^2 - 3x + 2}{x + 1}\right) = \ln\left(\frac{(x-2)(x-1)}{x+1}\right)$$

$$
\begin{array}{ccccccc}
- & & + & & - & & + \\
\end{array}
$$

$$-1 \qquad 1 \qquad 2$$

Domain $\begin{cases} -1 < x < 1 \\ x > 2 \end{cases}$

3) d) $Limits$:

$$\lim_{x \to 0} \frac{x^2}{1 + 2^{\frac{1}{x}}}$$

3) d) *Limits*:

$$\lim_{x \to 0} \frac{x^2}{1 + 2^{\frac{1}{x}}} \begin{cases} \lim_{x \to 0^+} \dfrac{x^2}{1 + 2^{\frac{1}{x}}} = \dfrac{0^+}{\infty} = 0 \\[4mm] \lim_{x \to 0^-} \dfrac{x^2}{1 + 2^{\frac{1}{x}}} = \dfrac{0^+}{1} = 0 \end{cases}$$

3) e) *Limits*:

$$\lim_{x \to 0} \frac{2}{3 + 4^{\frac{1}{x}}}$$

3) e) *Limits*:

$$\lim_{x \to 0} \frac{2}{3 + 4^{\frac{1}{x}}} \begin{cases} \lim_{x \to 0^+} \dfrac{2}{3 + 4^{\frac{1}{x}}} = \dfrac{2}{\infty} = 0 \\[4mm] \lim_{x \to 0^-} \dfrac{2}{3 + 4^{\frac{1}{x}}} = \dfrac{2}{3} \end{cases}$$

3) h) $Limits$:

$$\lim_{x \to \infty} \left(\frac{x+1}{x+4}\right)^{\left(\frac{x^2}{x+1}\right)} = 1^\infty$$

3) *e) Limits*:

$$\lim_{x \to \infty} \left(\frac{x+1}{x+4} \right)^{\left(\frac{x^2}{x+1} \right)} = e^{\lim_{x \to \infty} \left(\frac{x^2}{x+1} \right) \left(\frac{x+1}{x+4} - 1 \right)} =$$

$$= e^{\lim_{x \to \infty} \left(\frac{x^2}{x+1} \right) \left(\frac{-3}{x+4} \right)} = e^{\lim_{x \to \infty} \left(\frac{-3x^2}{x^2+5x+4} \right)} = e^{\frac{-3}{2}}$$