(1.) Let \( f(x) = \frac{x - 1}{(x - 2)(x + 2)}. \)

(a) Find the domain of \( f \) and write it as a union of intervals.

\((-\infty, -2) \cup (-2, 2) \cup (2, \infty)\)

(b) Find

\[
f(4) = \frac{3}{(2)(6)} = \frac{1}{4}
\]

(c) Find the Average Rate of Change (AROC) of \( f(x) \) over the interval \([1, 4]\).

\[
\text{AROC}_{1,4} = \frac{f(4) - f(1)}{4 - 1} = \frac{\frac{1}{4} - 0}{3} = \frac{1}{12}
\]
(2.)

(a) Find the equation of the line passing through the points \((1, 4)\) and \((\frac{1}{2}, 8)\).

First find the slope of the line.

\[
slope = \frac{8 - 4}{\frac{1}{2} - 1} = \frac{4}{-\frac{1}{2}} = -8
\]

The point-slope form gives \(y - 4 = -8(x - 1)\)

(b) Find the point-slope form of the line passing through the point \((-1, -2)\) with slope 5.

Directly using point-slope form of a line gives \(y + 2 = 5(x + 1)\)

(3.)
Suppose the population, \(P(t)\) of the city of Birmingbeef, MI (in thousands of people) is given in the table below where \(t\) represents the number of years since 1980.

<table>
<thead>
<tr>
<th>(t)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>(P(t))</td>
<td>26</td>
<td>19</td>
<td>12</td>
<td>5</td>
</tr>
</tbody>
</table>

Is the growth (or decay) of the population linear? Show the calculations that support this. If it is linear, find the equation of the line and find the \(t\)-intercept (horizontal intercept) of the line. What does the \(t\)-intercept represent in this case?

Yes, it is linear since the top row is evenly spaced with a spacing of 5 and the bottom is evenly spaced with a spacing -7. Thus the AROC is always \(-\frac{7}{5}\) and is the slope of the line. The equation of the line is then \(P(t) = -\frac{7}{5}t + 26\) (using point slope form with the point \((0, 26)\)). We find the \(t\)-intercept by setting

\[
P(t) = 0 = -\frac{7}{5}t + 26
\]

\[
\frac{7}{5}t = 26
\]

\[
t = \frac{26(5)}{7} \approx 18.57 \text{ thousands of people}
\]

This means that the city will be empty of people between the years of 1998 and 1999.