## Problem 1. Section 2.4 #132

*Determine the point(s), if any, at which the function* $f(x) = \frac{2}{x^2+1}$ *is discontinuous. Classify any discontinuity as jump, removable, infinite, or other.*

Since $x^2+1 = 0$ has no (real) solutions, we conclude that the function has $\boxed{\text{no discontinuities}}$.

## Problem 2. Section 2.4 #134

*Determine the point(s), if any, at which the function* $g(t) = t^{-1}+1$ *is discontinuous. Classify any discontinuity as jump, removable, infinite, or other.*

Since we can write $g(t) = \frac{1}{t} + 1$, we see that $g$ has an $\boxed{\text{infinite discontinuity at } t = 0}$.

## Problem 3. Section 2.4 #136

*Determine the point(s), if any, at which the function* $f(x) = \frac{|x-2|}{x-2}$ *is discontinuous. Classify any discontinuity as jump, removable, infinite, or other.*

We can rewrite $f$ as a piecewise function:

$$f(x) = \begin{cases} -1 & x < 2 \\ 1 & x > 2 \end{cases}$$

We see that $f$ has a $\boxed{\text{jump discontinuity at } x = 2}$.

## Problem 4. Section 2.4 #138

*Determine the point(s), if any, at which the function* $f(t) = \frac{t+3}{t^2+5t+6}$ *is discontinuous. Classify any discontinuity as jump, removable, infinite, or other.*

We can factor the denominator $t^2 + 5t + 6 = (t + 2)(t + 3)$, so $f(t) = \frac{1}{t+2}$, keeping in mind that $t = -3$ is still not in the domain of $f$. Since the denominator of $f$ can still be zero at $t = -2$, we see that we have a $\boxed{\text{removable discontinuity at } t = -3}$ and an $\boxed{\text{infinite discontinuity at } t = -2}$.

## Problem 5. Section 2.4 #142

*Decide if the function* $f(y) = \frac{\sin(\pi y)}{\tan(\pi y)}$ *is continuous at* $y = 1$*. If it is discontinuous, what type of discontinuity is it?*

$$f(y) = \frac{\sin(\pi y)}{\tan(\pi y)} = \frac{\sin(\pi y)}{\frac{\sin(\pi y)}{\cos(\pi y)}} = \cos(\pi y)$$

This last step involved cancelling a $\sin(\pi y)$, so our function has removable discontinuities at $\sin(\pi y) = 0$. $y = 1$ is a solution to this equation, so $f(y)$ has a $\boxed{\text{removable discontinuity at } y = 1}$.

## Problem 6. Section 2.4 #146

*Find the value(s) of $k$ that make the function continuous over the given interval.*

$$f(\theta) = \begin{cases} \sin(\theta) & 0 \le \theta < \frac{\pi}{2} \\ \cos(\theta + k) & \frac{\pi}{2} \le \theta \le \pi \end{cases}$$

$$\begin{aligned} \sin(\frac{\pi}{2}) &= \cos(\frac{\pi}{2} + k) \\ 1 &= \cos(\frac{\pi}{2} + k) \\ \arccos(1) + 2\pi n &= \frac{\pi}{2} + k \\ 0 + 2\pi n &= \frac{\pi}{2} + k \\ \boxed{k = -\frac{\pi}{2} + 2\pi n} \end{aligned}$$

## Problem 7. Section 2.4 #148

*Find the value(s) of $k$ that make the function continuous over the given interval.*

$$f(\theta) = \begin{cases} e^{kx} & 0 \le x < 4 \\ x + 3 & 4 \le x \le 8 \end{cases}$$

$$\begin{aligned} e^{k}(4) &= (4) + 3 \\ e^{4k} &= 7 \\ 4k &= \ln 7 \\ \boxed{k = \frac{1}{4}\ln 7} \end{aligned}$$

## Problem 8. Section 2.4 #154

*Consider the graph of the function $y = f(x)$ shown in the graph.*

a. *Find all values for which the function is discontinuous.*

The function is discontinuous at $\boxed{x = -1, 0}$.

b. *For each value in part a., state why the formal definition of continuity does not apply.*

For the discontinuity at $x = -1$, the left-sided limit is 3, which does not agree with the right-sided limit of 1. For the discontinuity at $x = 0$, the left-sided limit is $\infty$.

c. *Classify each discontinuity as either jump, removable, or infinite.*

The discontinuity at $x = -1$ is a jump discontinuity. The discontinuity at $x = 0$ is an infinite discontinuity.