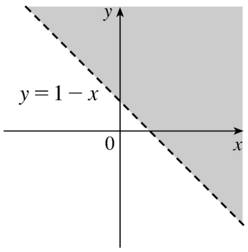
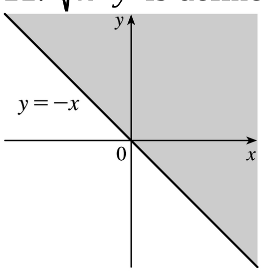
6. **(a)** $f(1,1) = \ln(1+1-1) = \ln 1 = 0$
(b) $f(e,1) = \ln(e+1-1) = \ln e = 1$
(c) $\ln(x+y-1)$ is defined only when $x+y-1>0$, that is, $y>1-x$. So the domain of f is $\{(x,y) \mid y>1-x\}$.

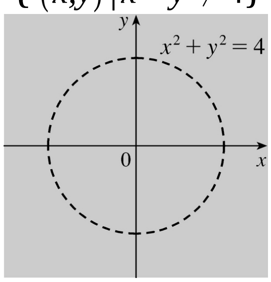


(d) Since $\ln(x+y-1)$ can be any real number, the range is R.

11. $\sqrt{x+y}$ is defined only when $x+y \geq 0$, or $y \geq -x$. So the domain of f is $\{(x,y) \mid y \geq -x\}$.



15. $\dfrac{3x+5y}{x^2+y^2-4}$ is defined only when $x^2+y^2-4 \neq 0$, or $x^2+y^2 \neq 4$. So the domain of f is $\{(x,y) \mid x^2+y^2 \neq 4\}$.



30. All six graphs have different traces in the planes $x=0$ and $y=0$, so we investigate these for each function.
(a) $f(x,y) = |x| + |y|$. The trace in $x=0$ is $z=|y|$, and in $y=0$ is $z=|x|$, so it must be graph VI.
(b) $f(x,y) = |xy|$. The trace in $x=0$ is $z=0$, and in $y=0$ is $z=0$, so it must be graph V.
(c) $f(x,y) = \dfrac{1}{1+x^2+y^2}$. The trace in $x=0$ is $z=\dfrac{1}{1+y^2}$, and in $y=0$ is $z=\dfrac{1}{1+x^2}$. In addition, we can see that f is close to 0 for large values of x and y, so this is graph I.

(d) $f(x,y)=\left(x^2-y^2\right)^2$. The trace in $x=0$ is $z=y^4$, and in $y=0$ is $z=x^4$. Both graph II and graph IV seem plausible; notice the trace in $z=0$ is $0=\left(x^2-y^2\right)^2 \Rightarrow y=\pm x$, so it must be graph IV.
(e) $f(x,y)=(x-y)^2$. The trace in $x=0$ is $z=y^2$, and in $y=0$ is $z=x^2$. Both graph II and graph IV seem plausible; notice the trace in $z=0$ is $0=(x-y)^2 \Rightarrow y=x$, so it must be graph II.
(f) $f(x,y)=\sin\left(|x|+|y|\right)$. The trace in $x=0$ is $z=\sin|y|$, and in $y=0$ is $z=\sin|x|$. In addition, notice that the oscillating nature of the graph is characteristic of trigonometric functions. So this is graph III.

32. If we start at the origin and move along the x –axis, for example, the z –values of a cone centered at the origin increase at a constant rate, so we would expect its level curves to be equally spaced. A paraboloid with vertex the origin, on the other hand, has z –values which change slowly near the origin and more quickly as we move farther away. Thus, we would expect its level curves near the origin to be spaced more widely apart than those farther from the origin. Therefore contour map I must correspond to the paraboloid, and contour map II the cone.