The functions f and g are defined as follows.

$$f(x) = \frac{x-8}{x^2+16x+64}$$

$$g(x) = \frac{x+5}{x^2-x-30}$$

For each function, find the domain.

Write each answer as an interval or union of intervals.

$x^2+16x+64 \neq 0$

$(x+8)(x+8) \neq 0$

$x \neq -8$

$f(x) = (-\infty, -8) \cup (-8, \infty)$

$x^2 - x - 30 \neq 0$

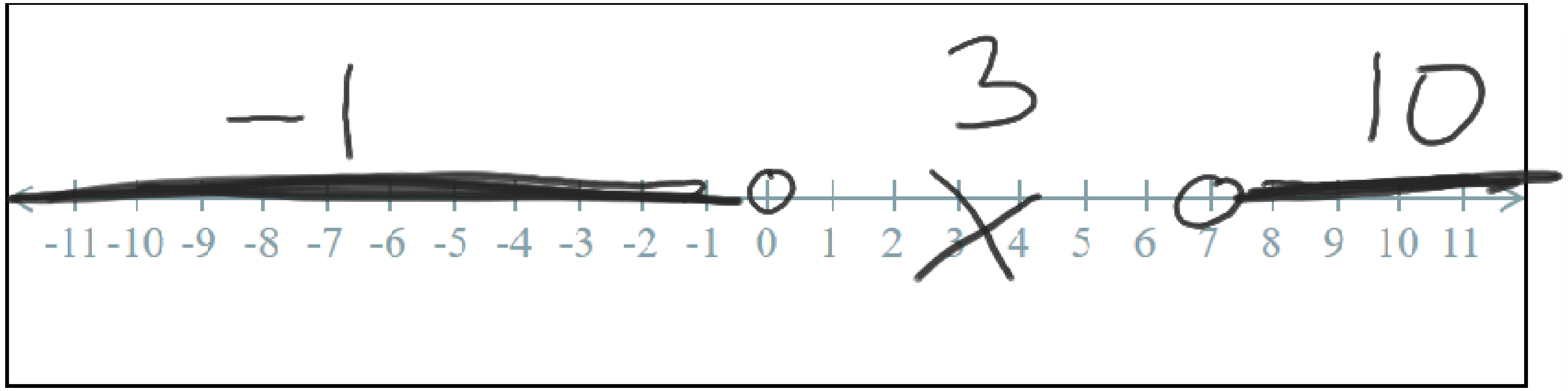
$(x+5)(x-6) \neq 0$

$x \neq -5 \quad x \neq 6$

$g(x) = (-\infty, -5) \cup (-5, 6) \cup (6, \infty)$

Graph the solution to the following inequality on the number line.

$x(x-7)>0$ $x=0$ $x=7$



$-1(-1-7)$ $3(3-7)$ $10(10-7)$

$-1(-8)$ $3(-4)$ $10(3)$

$8>0$ $-12>0$ $30>0$

Graph the solution to the following inequality on the number line.

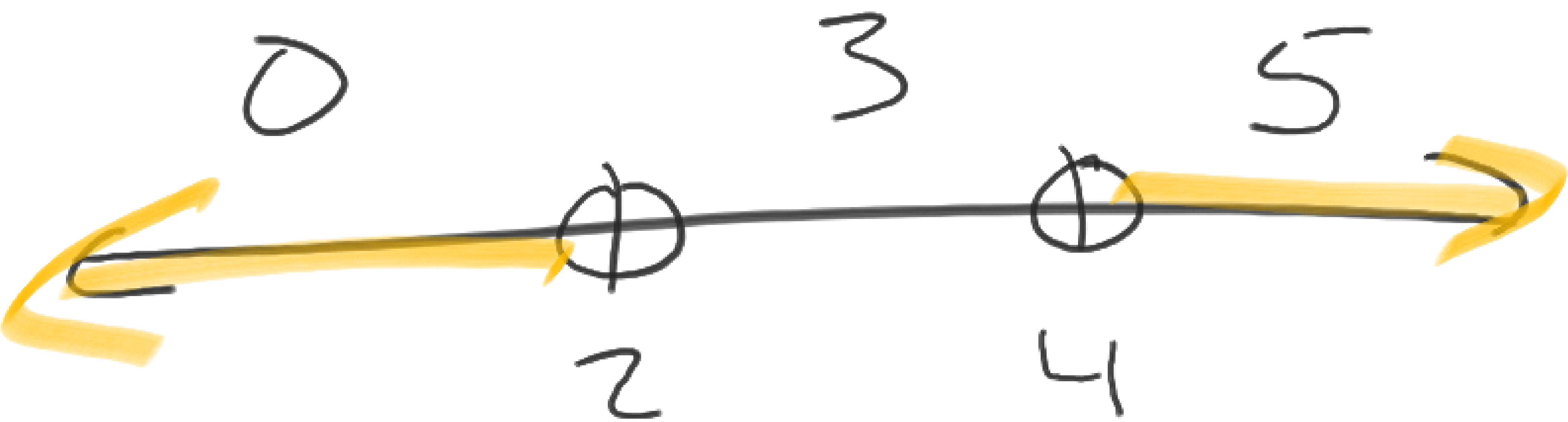
$$x^2 - 6x > -8$$

Note that you can use the ALEKS graphing calculator to help get your answer.

$x^2 - 6x + 8 > 0$

$(x-4)(x-2) > 0$

$x = 4 \quad x = 2$



$0 - 0 > -8$

$9 - 18$

$-9 > -8$

$25 - 30 > -8$

$-5 > -8$

$$
\begin{array}{r}
1\,2\,2\,0 \\
6\overline{)\,7\,3\,2\,5} \\
-6 \\
\hline
1\,3 \\
-1\,2 \\
\hline
1\,2 \\
-1\,2 \\
\hline
0\,5 \\
R\,5
\end{array}
$$

$1220\frac{5}{6}$

$$
\begin{array}{r}
x-7 \\
x-6\overline{)\,x^2-13x+39} \\
-x^2+6x \\
\hline
-7x+39 \\
+7x-42 \\
\hline
-3
\end{array}
$$

$x-7 \quad R\ -3$

$$\left(8x^3+2x^2+7x+2\right)\div\left(2x^2+x\right)$$

$$4x-1 \quad Q$$

$$2x^2+x\ \overline{)\,8x^3+2x^2+7x+2}$$

$$-\left(8x^3+4x^2\right)$$

$$-2x^2+7x+2$$

$$-\left(-2x^2-x\right)$$

$$8x+2 \quad R$$

$$\begin{array}{r}
Q \qquad 7x^2 + 2x + 3 \\
-x^2 + x + 3 \overline{\smash{\big)}\, -7x^4 + 5x^3 + 20x^2 + 0x + 10} \\
+7x^4 \mp 7x^3 \mp 21x^2 \qquad\qquad \\
\hline
-2x^3 - x^2 + 0x + 10 \\
+2x^3 \mp 2x^2 \mp 6x \qquad\; \\
\hline
-3x^2 - 6x + 10 \\
+3x^2 \mp 3x \mp 9 \\
\hline
-9x + 1 \quad R
\end{array}$$

$$\left(9x^3+6x^2-21x+7\right)\div\left(3x-1\right)$$

$$
\begin{array}{r}
3x^2+3x-6 \\
3x-1\overline{)\,9x^3+6x^2-21x+7} \\
-9x^3+3x^2 \\
\hline
9x^2-21x+7 \\
-9x^2+3x \\
\hline
-18x+7 \\
+18x\mp 6 \\
\hline
1
\end{array}
$$

$$3x^2+3x-6+\frac{1}{3x-1}$$

$3x-1=0 \qquad x=1/3$

$$
\begin{array}{c|cccc}
1/3 & 9 & 6 & -21 & 7 \\
 & \downarrow & 3 & 3 & -6 \\
\hline
 & 9 & 9 & -18 & 1
\end{array}
$$

$$9x^2+9x-18+\frac{1}{x-1/3}$$

$x^3 - 11x + 14$ is divided by $x-2$ $= 0$ $x = 2$

$$\begin{array}{r|rrrr} 2 & 1 & 0 & -11 & 14 \\ & \downarrow & 2 & 4 & -14 \\ \hline & 1 & 2 & -7 & 0 \end{array}$$

$1x^2 + 2x - 7$ R 0

Remainder theorem:

If a polynomial $P(x)$ is divided by $x-c$, then the remainder is $P(c)$.

Use the remainder theorem to find $P(2)$ for $P(x) = -x^4 + 2x^3 - 4x + 5$.

$P(2) = -(2)^4 + 2(2)^3 - 4(2) + 5$

$-16 + 16 - 8 + 5 = -3$

$$\begin{array}{r|rrrrr} 2 & -1 & 2 & 0 & -4 & 5 \\ & & -2 & 0 & 0 & -8 \\ \hline & -1 & 0 & 0 & -4 & -3 \end{array}$$

Use the Factor Theorem to determine whether $x-2$ is a factor of $P(x) = 2x^4 - x^3 + 3x - 9$.

$x = 2$

$$\begin{array}{r|rrrrr} 2 & 2 & -1 & 0 & 3 & -9 \\ & & 4 & 6 & 12 & 30 \\ \hline & 2 & 3 & 6 & 15 & 21 \end{array}$$

not a factor

$P(2) = 21$

$\overset{Q}{1}x^4 - 2x^3 + x^2 - 8x - 12$ P

is $(x-3)$ a factor

$$\begin{array}{r|rrrrr} 3 & 1 & -2 & 1 & -8 & -12 \\ & & 3 & 3 & 12 & 12 \\ \hline & 1 & 1 & 4 & 4 & 0 \end{array}$$

yes

$x = 3$ is zero

$P \to 1, 2, 3, 4, 6, 12$

$\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12$

$Q \to 1$

Q P

$1x^4 - 2x^3 + x^2 - 8x - 12$

is $(x-3)$ a factor

$$
\begin{array}{r|rrrrr}
3 & 1 & -2 & 1 & -8 & -12 \\
 & & 3 & 3 & 12 & 12 \\
\hline
 & 1 & 1 & 4 & 4 & 0
\end{array}
$$

yes

$x = 3$ is zero

$x^3 + x^2 + 4x + 4$

$$
\begin{array}{r|rrrr}
-1 & 1 & 1 & 4 & 4 \\
 & \downarrow & -1 & 0 & -4 \\
\hline
 & 1 & 0 & 4 & 0
\end{array}
$$

$$\boxed{(x^2+4)(x-3)(x+1)}$$

The function below has at least one rational zero.
Use this fact to find *all* zeros of the function.

step 1 ± 10

step 2 graph find Integer zeros

$$h(x) = 7x^4 - 50x^3 + 76x^2 - 3x - 10$$

2, 5

$$\begin{array}{r|rrrrr} 2 & 7 & -50 & 76 & -3 & -10 \\ & & 14 & -72 & 8 & 10 \\ \hline & 7 & -36 & 4 & 5 & 0 \end{array}$$

$(x-2)(x-5)(7x^2-x-1)$

$$\begin{array}{r|rrrr} 5 & 7 & -36 & 4 & 5 \\ & & 35 & -5 & -5 \\ \hline & 7 & -1 & -1 & 0 \end{array}$$

$(7x^2 - x - 1)$

$a = 7 \quad b = -1 \quad c = -1$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$b^2 - 4ac$

$(-1)^2 - 4(7)(-1)$

$1 + 28 = 29$

$$x = \frac{-(-1) \pm \sqrt{29}}{2(7)}$$

$$x = \frac{1 \pm \sqrt{29}}{14}$$