1. (15 pts.)
   (a) $i^{616} = (i^2)^{308} = (-1)^{308} = 1$
   (b) $(-3 + \sqrt{-25})^2 = (-3 + 5i)^2 = 9 - 30i + 25i^2 = 9 - 25 - 30i = -16 - 30i$

2. (8 pts.) The center of the circle is $(\frac{7+1}{2}, \frac{3-2}{2}) = (4, \frac{1}{2})$. The radius of the circle is $\frac{1}{2}\sqrt{(7-1)^2 + (3+2)^2} = \frac{1}{2}\sqrt{36 + 25} = \frac{1}{2}\sqrt{61}$. The equation of the circle is $(x - 4)^2 + (y - \frac{1}{2})^2 = \frac{61}{4}$.

3. (25 pts.)
   (a) Identify $w = \frac{1}{x+1}$. Then the equation becomes $w^2 + 4w - 12 = 0 \Rightarrow (w - 2)(w + 6) = 0 \Rightarrow w = 2$ or $w = -6 \Rightarrow \frac{1}{x+1} = 2$ or $\frac{1}{x+1} = -6 \Rightarrow 1 = 2x + 2$ or $1 = -6x - 6 \Rightarrow x = -\frac{1}{2}$ or $x = -\frac{7}{6}$.
   (b) $(2x + 1)(x + 3) = 0 \Rightarrow 2x + 1 = 0$ or $x + 3 = 0 \Rightarrow x = -\frac{1}{2}$ or $x = -3$.
   (c) $(x - 5)^4 = 80 \Rightarrow x - 5 = \pm\sqrt[4]{80} \Rightarrow x = 5 \pm 2\sqrt{5}$

4. (20 pts.)
   (a) $|x + 1| < 5 \Rightarrow -5 < x + 1 < 5 \Rightarrow -6 < x < 4$. The solution set is $(-6, 4)$.
   (b) $x(x - 2)(x + 2) \geq 0$

<table>
<thead>
<tr>
<th>$x$</th>
<th>$(-\infty, -2)$</th>
<th>$(-2, 0)$</th>
<th>$(0, 2)$</th>
<th>$(2, \infty)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>sign of $x$</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>sign of $x - 2$</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>sign of $x + 2$</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
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</tbody>
</table>

The solution set is $[-2, 0] \cup [2, \infty)$.

5. (8 pts.) Writing $x + 2y = 1$ in slope-intercept form gives $y = -\frac{1}{2}x + \frac{1}{2}$. The slope of the line perpendicular to $y = -\frac{1}{2}x + \frac{1}{2}$ is 2. So the equation of the line is $y - 4 = 2(x + 3) \Rightarrow y = 2x + 6 + 4 \Rightarrow y = 2x + 10$.

6. (8 pts.) Identify $x =$ number of miles. Then the cost for using Plan A is $30 + 0.1x$ dollars per day and the cost for using Plan B is $50$ dollars per day. We want $30 + 0.1x > 50 \Rightarrow 0.1x > 20 \Rightarrow x > 200$. Therefore Plan B will save you money if you drive more than 200 miles per day.

7. (8 pts.) Identify $w =$ width of pasture. Then $2w =$ length of pasture. Since its area is $115200$ ft$^2$, we have $(2w)(w) = 115200 \Rightarrow 2w^2 = 115200 \Rightarrow w^2 = 57600 \Rightarrow w = \pm 240$. So the pasture is 240 ft wide.

8. (8 pts.) $x^2 - 2x + 1 + y^2 + 4y + 4 = -1 + 1 + 4 \Rightarrow (x - 1)^2 + (y + 2)^2 = 4$. The center is $(1, -2)$ and the radius is 2.

9. (Bonus: 10 pts) The equation has exactly one solution if the discriminant is zero, i.e. $k^2 - 4(4)(25) = 0 \Rightarrow k^2 - 400 = 0 \Rightarrow k^2 = 400 \Rightarrow k = \pm 20$.

10. (Bonus: 10 pts) $\sqrt{11} + 8x + 1 = 81 \Rightarrow \sqrt{11} + 8x = 80 \Rightarrow 11 + 8x = 6400 \Rightarrow 8x = 6389 \Rightarrow x = \frac{6389}{8}$