Problem 1
Find the Domain and Range for $f(x) = x^2 - 1$

**Solution:** Domain is all reals, (i.e. $x \in (-\infty, \infty)$), and the range is $[-1, \infty)$.

Problem 2
Find the Domain and Range for

$$f(x) = \begin{cases} x^2 & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

**Solution:** Domain is all reals, and the range is $[0, \infty)$.

Problem 3
Sketch the straight line determined by the points $(-1, 3), (2, 3)$, and find the slope-intercept equation (i.e. $f(x) = mx + b$).

**Solution:** The slope of our line is $m = (3 - 3)/(2 - (-1)) = 0$. Then by plugging in $(-1, 3)$ into our equation, $f(x) = b$, we have $b = 3$. Thus the answer is $f(x) = 3$.

Problem 4 and 5
Given $f(x) = x^2 - 6x + 7$, express it in quadratic standard form (i.e. $y = a(x - x_0)^2 + y_0$). Also find all $x$ and $y$ intercepts.

**Solution:** Notice we have

$$f(x) = x^2 - 6x + 7 = x^2 - 6x + (9 - 9) + 7 = (x^2 - 6x + 9) + (-9 + 7) = (x - 3)^2 - 2$$

To solve for the $y$ intercept, we set $x = 0$, and have $y = (0)^2 - 6(0) + 7 = 7$. For the $x$ intercept, we set $y = f(x) = 0$, and have

$$(x - 3)^2 - 2 = 0 \Rightarrow (x - 3)^2 = 2 \Rightarrow x - 3 = \pm \sqrt{2} \Rightarrow x = \pm \sqrt{2} + 3$$

Hence there are two $x$ intercepts, at $x = \sqrt{2} + 3$ and $x = -\sqrt{2} + 3$. 

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Problem 6

Find a function whose graph is a parabola with vertex (1, 3) and that passes through the point (−2, 5).

Solution: By using the standard equation for a parabola, \( y = a(x - x_0)^2 + y_0 \), we have our vertex \((x_0, y_0) = (1, 3)\). Thus we have

\[
  y = a(x - 1)^2 + 3
\]

Now to solve for \(a\) we plug in the point \((-2, 5)\) into our equation, and have

\[
  5 = a(-2 - 1)^2 + 3 \Rightarrow 5 = 9a + 3 \Rightarrow a = \frac{2}{9}
\]

Hence our answer is \(y = (2/9)(x - 1)^2 + 3\). 

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