11.

$$f(x) = \frac{x^2 - 4}{x - 5}$$

Since $\lim_{x\to\pm\infty} f(x) = \pm\infty$ (Rational function - you should know how to do this by inspection.) there are no horizontal asymptotes. Since the denominator vanishes only at $x = 5$, $x = 5$ is the only *possible* vertical asymptote. Since $\lim_{x\to 5^+} f(x) = +\infty$, $x = 5$ is a vertical asymptote. The calculation $\lim_{x\to 5^-} f(x) = -\infty$ also helps you draw the curve had that been required, but you only need one of the one–sided limits to be $\pm\infty$ to have a vertical asymptote.

Since the degree of the numerator minus the degree of the denominator is $2 - 1 = 1$, there is an oblique asymptote. The calculation $f(x) = \dfrac{x^2 - 4}{x - 5} = x + 5 + \dfrac{21}{x - 5}$ shows that the oblique asymptote is the line $y = x + 5$.

12. The slope of the graph is the derivative. In this case, evaluated at $x = 1$, so we need to compute

$$slope = \lim_{x\to 1} \frac{(x+1)^2 - 4}{x - 1}$$

After this proceed as follows:

$$\lim_{x\to 1} \frac{(x+1)^2 - 4}{x - 1} = \lim_{x\to 1} \frac{x^2 + 2x + 1 - 4}{x - 1} = \lim_{x\to 1} \frac{x^2 + 2x - 3}{x - 1}$$
$$= \lim_{x\to 1} \frac{(x-1)(x+3)}{x - 1} = \lim_{x\to 1} x + 3 = 4\ .$$

13. Since we have no air resistance and we drop the rock with an initial velocity of 0 at a height 0 above the ground, the position of the rock at time t seconds is $s(t) = -\frac{1}{2}gt^2$, as it says in the **Hint:**. When the rock hits the water, $s(t) = -100$ so we get the equation $-100 = -\frac{1}{2}gt^2$, or more conveniently

$$200 = gt^2$$

where t is the time at which the rock hits the water. If we can find t we can easily solve for g and what we know is that 2.6 seconds after we drop the rock, we *hear* it hit. Since sound travels at 1000 ft/sec, it takes $\frac{100}{1000} = 0.1$ seconds for sound from the bottom of the well to reach the top. Hence the rock hit the water $2.6 - 0.1 = 2.5$ seconds after it was dropped. Hence $g = \frac{200}{(2.5)^2}$. To simplify this without a calculator is not hard but only a point was deducted for not doing it so plan your time accordingly:

$$g = \frac{200}{(2.5)^2} = \frac{2\cdot 10^2}{(25)^2\cdot 10^{-2}} = \frac{2\cdot 10^4}{5^4} = 2\cdot 2^4 = 32\ .$$

14. We have $cot(\frac{\pi}{4}) - \frac{\pi}{4} = 1 - \frac{\pi}{4} = \frac{4-\pi}{4} > 0$. $cot(\frac{\pi}{2}) - \frac{\pi}{2} = 0 - \frac{\pi}{2} = -\frac{\pi}{2} < 0$. Since $cot(t) - t$ is a continuous function on $[\frac{\pi}{4}, \frac{\pi}{2}]$, $cot(t) - t = 0$ has a solution in the interval.

15. The line $y = 3x - 4$ is tangent to the unknown curve at the point $x = 2$. On the other hand, the equation for the tangent line to the curve $y = f(x)$ at the point $x = a$ is given by $y = f'(a)(x - a) + f(a)$. For this problem, $f(x)$ is unknown, but $a = 2$. Further, $y = 3x - 4 = 3(x - 2) + 2$, so $f(2) = 2$ and $f'(2) = 3$. Of course we have no idea what the values of $f(x)$ or $f'(x)$ are at any point other than 2.