11.4 1, 2, 9, 10, 13, 20, 22, 24, 30 1pt each, 9 pts total

1. $z = 4x^2 - y^2 + 2y$; $(-1, 2, 4)$

$f_x = 8x$ $\quad f_y = -2y + 2$

$f_x(-1,2) = -8$ $\quad f_y(-1,2) = -2$

Tangent plane: $z - z_0 = f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0)$

$z - 4 = -8(x+1) - 2(y-2)$

$\boxed{z = -8x - 2y}$

2. $e^{x^2 - y^2} = z$, $(1, -1, 1)$

$f_x = 2xe^{x^2-y^2}$ $\quad f_y = -2ye^{x^2-y^2}$

$f_x(1,-1) = 2$ $\quad f_y(1,-1) = 2$

Tangent plane: $z - 1 = 2(x-1) + 2(y+1)$

$\boxed{z = 2x + 2y + 1}$

9. $f(x,y) = x\sqrt{y}$, $(1,4)$ $\quad f(1,4) = 2$

f is differentiable at (1,4) if f_x, f_y exist and are continuous at (1,4).

$f_x = \sqrt{y}$ $\quad f_y = \frac{x}{2\sqrt{y}}$

$f_x(1,4) = 2$ $\quad f_y(1,4) = \frac{1}{4}$ $\quad$ So both partials exist & are continuous.

$L(x,y) = f(x_0, y_0) + f_x(x_0, y_0)(x - x_0) + f_y(x_0, y_0)(y - y_0)$

$$\boxed{\begin{aligned} L(x,y) &= 2 + 2(x-1) + \tfrac{1}{4}(y-4) \\ &= 2x + \tfrac{1}{4}y - 1 \end{aligned}}$$

10. $f(x,y) = x/y$, $(6,3)$ $\quad f(6,3) = 2$

Again, we need the partials to exist and be continuous at (6,3)

$f_x = \frac{1}{y}$ $\quad f_y = \frac{-x}{y^2}$

$$\boxed{\begin{aligned} L(x,y) &= 2 + \tfrac{1}{3}(x-6) - \tfrac{2}{3}(y-3) \\ &= \tfrac{1}{3}x - \tfrac{2}{3}y + 2 \end{aligned}}$$

$f_x(6,3) = \frac{1}{3}$ $\quad f_y(6,3) = \frac{-6}{9} = \frac{-2}{3}$