11.5: 2, 20, 28, 34, 36

2. $z = x\ln(x+2y)$, $x = \sin t$, $y = \cos t \quad \Rightarrow$

$$\frac{dz}{dt} = \frac{\partial z}{\partial x}\frac{dx}{dt} + \frac{\partial z}{\partial y}\frac{dy}{dt} = \left[x \cdot \frac{1}{x+2y} + 1 \cdot \ln(x+2y)\right]\cos t + x \cdot \frac{1}{x+2y}\,(2)\cdot(-\sin t)$$

$$= \left[\frac{x}{x+2y} + \ln(x+2y)\right]\cos t - \frac{2x}{x+2y}\,(\sin t)$$

20. $M = xe^{y-z^2}$, $x = 2uv$, $y = u - v$, $z = u + v \quad \Rightarrow$

$$\frac{\partial M}{\partial u} = \frac{\partial M}{\partial x}\frac{\partial x}{\partial u} + \frac{\partial M}{\partial y}\frac{\partial y}{\partial u} + \frac{\partial M}{\partial z}\frac{\partial z}{\partial u} = e^{y-z^2}(2v) + xe^{y-z^2}(1) + x(-2z)e^{y-z^2}(1)$$

$$= e^{y-z^2}(2v + x - 2xz),$$

$$\frac{\partial M}{\partial v} = \frac{\partial M}{\partial x}\frac{\partial x}{\partial v} + \frac{\partial M}{\partial y}\frac{\partial y}{\partial v} + \frac{\partial M}{\partial z}\frac{\partial z}{\partial v} = e^{y-z^2}(2u) + xe^{y-z^2}(-1) + x(-2z)e^{y-z^2}(1)$$

$$= e^{y-z^2}(2u - x - 2xz).$$

When $u = 3$, $v = -1$ we have $x = -6$, $y = 4$, and $z = 2$, so $\dfrac{\partial M}{\partial u} = 16$ and $\dfrac{\partial M}{\partial v} = 36$.

28. $yz = \ln(x+z)$, so let $F(x,y,z) = yz - \ln(x+z) = 0$. Then $\dfrac{\partial z}{\partial x} = -\dfrac{F_x}{F_z} = -\dfrac{-\frac{1}{x+z}(1)}{y - \frac{1}{x+z}(1)} = \dfrac{1}{y\,(x+z)-1}$,

$$\frac{\partial z}{\partial y} = -\frac{F_y}{F_z} = -\frac{z}{y - \frac{1}{x+z}} = -\frac{z\,(x+z)}{y\,(x+z)-1}.$$

34. $I = \dfrac{V}{R} \quad \Rightarrow \quad \dfrac{dI}{dt} = \dfrac{\partial I}{\partial V}\dfrac{dV}{dt} + \dfrac{\partial I}{\partial R}\dfrac{dR}{dt} = \dfrac{1}{R}\dfrac{dV}{dt} - \dfrac{V}{R^2}\dfrac{dR}{dt} = \dfrac{1}{R}\dfrac{dV}{dt} - \dfrac{I}{R}\dfrac{dR}{dt}$

$$= \tfrac{1}{400}(-0.01) - \tfrac{0.08}{400}(0.03) = -0.000031 \text{ A/s}$$

36. $f_o = \left(\dfrac{c+v_o}{c-v_s}\right)f_s = \left(\frac{332+34}{332-40}\right)460 \approx 576.6$ Hz. v_o and v_s are functions of time t, so

$$\frac{df_o}{dt} = \frac{\partial f_o}{\partial v_o}\frac{dv_o}{dt} + \frac{\partial f_o}{\partial v_s}\frac{dv_s}{dt} = \left(\frac{1}{c-v_s}\right)f_s \cdot \frac{dv_o}{dt} + \frac{c+v_o}{(c-v_s)^2}f_s \cdot \frac{dv_s}{dt}$$

$$= \left(\tfrac{1}{332-40}\right)(460)(1.2) + \tfrac{332+34}{(332-40)^2}(460)(1.4) \approx 4.65 \text{ Hz/s}$$