Instructions: Show all work. Use exact values unless specifically told to round.

1. Minimize the function $f(x, y) = 2x + y$ subject to the constraint $xy = 32$ using Lagrange Multipliers.

$$F(x, y, \lambda) = 2x + y - \lambda xy + 32\lambda$$

$$F_x = 2 - \lambda y = 0 \qquad \lambda = \frac{2}{y}$$

$$F_y = 1 - \lambda x = 0 \qquad \lambda = \frac{1}{x}$$

$$\rightarrow \frac{2}{y} = \frac{1}{x} \Rightarrow 2x = y$$

$$x(2x) = 32$$
$$2x^2 = 32$$
$$x^2 = 16$$
$$x = 4 \qquad x = -4$$
$$y = 8 \qquad y = -8$$

$$2(4) + 8 = 8 + 8 = 16 \qquad\qquad 2(-4) + (-8) = -8 - 8 = -16$$

$$(4, 8, 16)$$

Max

$$\boxed{\begin{array}{c}(-4, -8, -16)\\ \text{Min}\end{array}}$$