

5.1.

(18)

$$(a) \quad \lim_{x \rightarrow 0} \underbrace{\sin x}_{\downarrow 0} \cdot \underbrace{\ln(2x)}_{\downarrow -\infty} \quad (0 \times (-\infty))$$

$$= \lim_{x \rightarrow 0} \frac{\ln(2x)}{1/\sin x}$$

$$= \lim_{x \rightarrow 0} \frac{\frac{2}{2x}}{\frac{\cos x}{\sin^2 x}}$$

$$= \lim_{x \rightarrow 0} \frac{\sin^2 x}{x \cdot \cos x} \quad \left(\frac{0}{0}\right)$$

$$= \lim_{x \rightarrow 0} \frac{2 \sin x \cos x}{1 \cdot \cos x + x(-\sin x)} = 0.$$

$$(b) \quad \lim_{x \rightarrow \infty} \underbrace{2x}_{\downarrow \infty} \cdot \underbrace{\tan\left(\frac{1}{3x}\right)}_{\downarrow 0} \quad (\infty \times 0)$$

$$= \lim_{x \rightarrow \infty} \frac{\tan\left(\frac{1}{3x}\right)}{\frac{1}{2x}}$$

$$= \lim_{x \rightarrow \infty} \frac{\sec^2\left(\frac{1}{3x}\right) \frac{1}{3} \left(-\frac{1}{x^2}\right)}{\frac{1}{2} \left(-\frac{1}{x^2}\right)} = \frac{2}{3}$$

11. 7.

(75)

Picture

Condition

$$(x+2)(y+3) = 180$$

Objective

Maximize

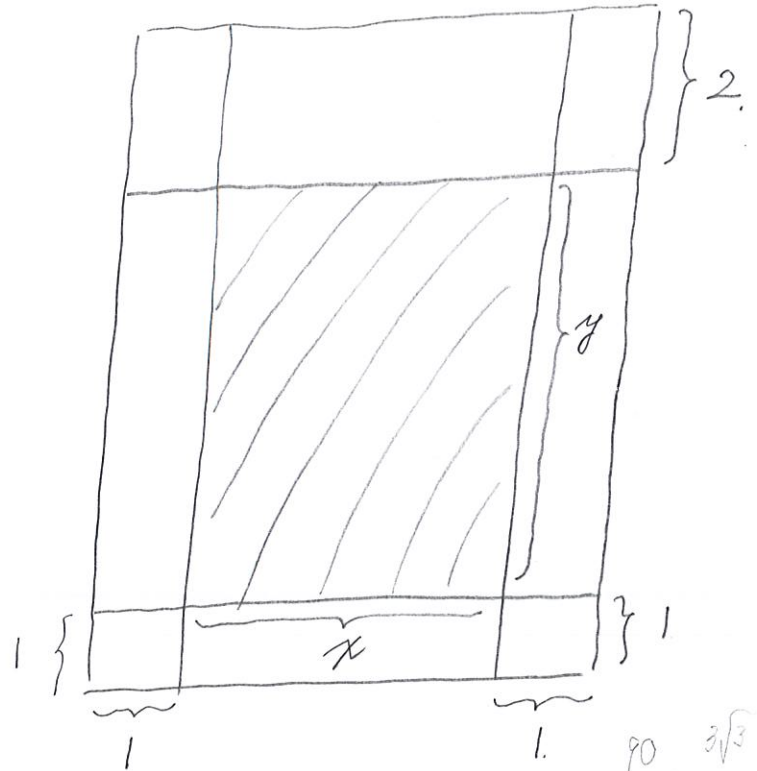
$$A = xy$$

$$A(x) = x \left( \frac{180}{x+2} - 3 \right)$$

$$0 < x < \frac{180}{3} = 60 - 2$$

Solution

$$\begin{aligned} A'(x) &= 1 \cdot \left( \frac{180}{x+2} - 3 \right) + x \cdot \left\{ -\frac{180}{(x+2)^2} \right\} \\ &= \frac{180(x+2) - 3(x+2)^2 - 180x}{(x+2)^2} \end{aligned}$$



$$\frac{180}{2\sqrt{30}} = 90\sqrt{3}$$

$$= \frac{-3x^2 - 12x + 348}{(x+2)^2}$$

$$= \frac{-3(x^2 + 4x - 116)}{(x+2)^2}$$

$$= \frac{-3 \{ x - (-2 + 2\sqrt{30}) \} \{ x - (-2 - 2\sqrt{30}) \}}{(x+2)^2}$$

$x$	$0$		$-2 + 2\sqrt{30}$		$58$
$A'(x)$		$+$	$0$	$-$	
$A(x)$		$\nearrow$	$\text{max}$	$\searrow$	

When  $x = -2 + 2\sqrt{30}$ .

$$\rightarrow y = 3\sqrt{30} - 3$$

∴ the printing area is the largest.