3. product : 192 sum: minimum

$xy = 192$

$x = \frac{192}{y}$

$S = x + y$

$S = \frac{192}{y} + y$

$192y^{-1}$

$S' = -192y^{-2} + 1 = 0$

$y^{-2} = \frac{1}{192}$

$\frac{1}{y^2} = \frac{1}{192}$

$\sqrt{y^2} = \sqrt{192} < \sqrt[4]{48} < \sqrt[4]{12} < \sqrt[4]{3}$

$y = 2 \cdot 2 \cdot 2\sqrt{3}$

$y = 8\sqrt{3}$

$x = \frac{192}{8\sqrt{3}} = \frac{24}{\sqrt{3}} = \frac{24\sqrt{3}}{3} = 8\sqrt{3}$

$8\sqrt{3}, 8\sqrt{3}$

4. Product = 192

Sum of first plus 3 times 2nd is minimum

$xy = 192$ $\quad S = x + 3y$

$x = \frac{192}{y}$ $\quad S = \frac{192}{y} + 3y$

8. max area $\quad$ perim = P

$A = \ell w$ $\quad P = 2\ell + 2w$

$w = \frac{P - 2\ell}{2}$

$A = \ell\left(\frac{P-2\ell}{2}\right)$

$A = \frac{1}{2}P\ell - \ell^2$

$A' = \frac{1}{2}P - 2\ell = 0$

$\frac{1}{2}\frac{1}{2}P = 2\ell \cdot \frac{1}{2}$

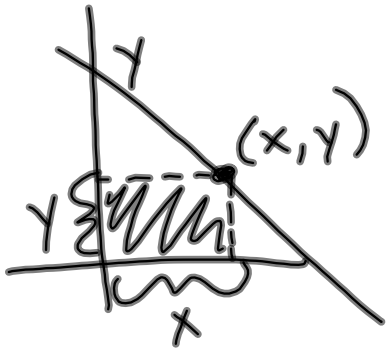
$\ell = \frac{1}{4}P$ $\quad w = \frac{P-2\ell}{2} = \frac{P-2(\frac{1}{4}P)}{2}$

$w = \frac{\frac{1}{2}P}{2} = \frac{1}{4}P$

$\boxed{\frac{1}{4}P \times \frac{1}{4}P}$

22. $y = (6 - x)/2$

$l + w = ?$ max area



$A = xy$

$A = x\left(\frac{6-x}{2}\right)$

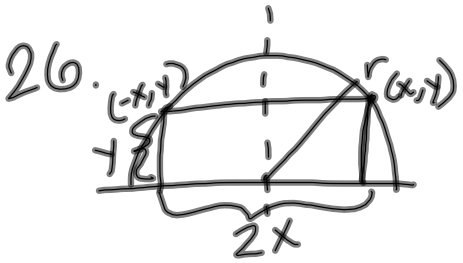
$A = 3x - \frac{1}{2}x^2$

$A' = 3 - x = 0$

$x = 3 \qquad y = \frac{6-3}{2} = 1.5$

3×1.5

26.



$$x^2+y^2=r^2$$

$$y=\sqrt{r^2-x^2}$$

$$A=y(2x)$$

$$A=2x\sqrt{r^2-x^2}$$

$$A'=2x\left(\tfrac{1}{2}(r^2-x^2)^{-1/2}(-2x)\right)+\left(r^2-x^2\right)^{1/2}(2)$$

$$A'=\left(\frac{-2x^2}{\sqrt{r^2-x^2}}+2\sqrt{r^2-x^2}=0\right)\sqrt{r^2-x^2}$$

$$-2x^2+2(r^2-x^2)=0$$

$$-4x^2+2r^2=0$$

$$\frac{4x^2=2r^2}{4}$$

$$x^2=\frac{r^2}{2}$$

$$x=\frac{r}{\sqrt{2}}=\frac{r\sqrt{2}}{2}$$

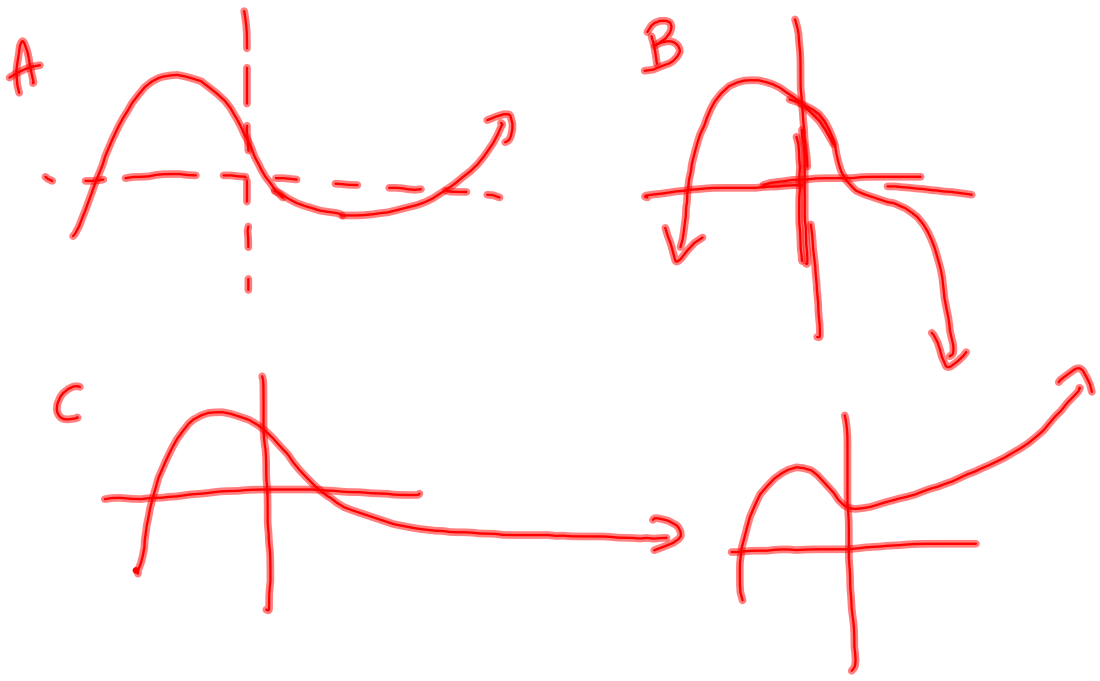
$$y=\sqrt{r^2-x^2}$$

$$y=\sqrt{r^2-r^2/2}$$

$$y=\sqrt{\frac{r^2}{2}}=\frac{r\sqrt{2}}{2}$$

$$\boxed{\frac{r\sqrt{2}}{2}\times\frac{r\sqrt{2}}{2}}$$

	-3	0	2
$f'(x)$	0	0	+
$f''(x)$	−	0	+
	inc. down	max	decr. down
		ip	incr. up



$f(x) = 7x^4 - 3x^2 + 2$ when is it concave down?

$f'(x) = 28x^3 - 6x$

$f''(x) = 84x^2 - 6 = 0$

$x = \sqrt{6/84} = \pm .267$

	$-.267$		$+.262$	
$f''(x)$	$+$	0	$-$	0 $+$

concave down $(-.267, .267)$