$\boxed{3.3}$ $\boxed{\#19}$

$$x^2+9y+10x-47=0$$

$$-9y=x^2+10x-47$$

$$y=\frac{-1}{9}x^2-\frac{10}{9}x+\frac{47}{9}$$

max

this is concave down parabola, so its vertex will be a max (no min pt)

vertex: $x=\frac{-b}{2a}=\frac{-(10/9)}{2(-1/9)}=\frac{10}{2}=5$

$$y(5)=\frac{-1}{9}(5^2)-\frac{10}{9}(5)+\frac{47}{9}=\frac{-25-50+47}{9}=\frac{-28}{9}$$

max at $y=\frac{-28}{9}$ w/ ~~x~~ value of 5.

$\boxed{\#25}$ $C(x)=3x^2+x+48$ concave up parabola

$\Rightarrow$ vertex is min

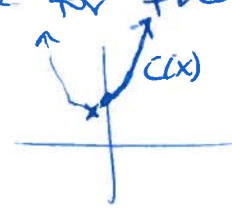
vertex at: $x=\frac{-1}{2(3)}=\frac{-1}{6}$

$$C\left(\frac{-1}{6}\right)=3\left(\frac{-1}{6}\right)^2+\left(\frac{-1}{6}\right)+48=\frac{3}{36}-\frac{1}{6}+48=\frac{3-6}{36}+48$$

$$=\frac{-1}{12}+48$$

$\boxed{\$47\tfrac{11}{12}}$

however, it doesn't make sense for there to be $\frac{-1}{6}$ of a commodity



$\Rightarrow$ min occurs at $(0, 48)$

#39

$d(x) = -0.0005x^2 + 2.39x + 600$

max

d = ht (ft) above canyon floor

x = horiz dist (ft)

max height at vertex

$$x = \frac{-2.39}{2(-0.0005)} = \frac{2.39}{0.1} = 2390 \text{ ft}$$

$$d(2390) = -0.0005(2390^2) + 2.39(2390) + 600$$

$$\boxed{= 3456.05 \text{ ft}}$$

#47

600 passengers each day

now: \$5/person

50 additional people will ride for each 25¢ decrease in fare

– What fare maximizes revenue?

R = revenue (\$)

x = # passengers

n (counter)	x	fare/person	R
0	600	5	5(600)
1	650	4.75	4.75(650)
2	700	4.50	4.50(700)
3	750	4.25	4.25(750)
	⋮		
n	$600+50n$	$5-0.25n$	$(600+50n)(5-0.25n)$

counter n represents # of decreases in original fare.

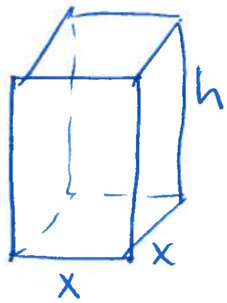
$$R(n) = (600+50n)(5-0.25n)$$
$$= 3000 - 150n + 250n - 12.5n^2$$
$$R(n) = -12.5n^2 + 100n + 3000$$

max

max revenue when $n = \dfrac{-100}{2(-12.5)} = 4$

$\Rightarrow$ fare is $5 - 0.25(4) = \boxed{\$4}$

$\boxed{\#57}$



need surface area because we are calculating cost of material to make box.

$$SA = \underbrace{(x^2+4xh)}_{\text{base + sides}} + \underbrace{x^2}_{\text{top}}$$

$$Cost = 1(x^2+4xh) + 5x^2 = 72$$

dimensions to maximize volume = ?

$$6x^2+4xh=72$$
$$4xh = 72-6x^2$$
$$h = \frac{72-6x^2}{4x}$$

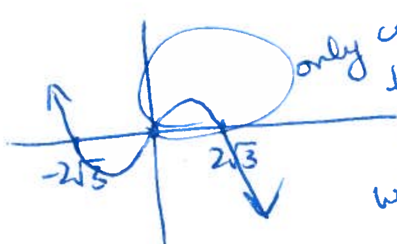
$V = x^2h$ ← plug in

$$V = x^{\cancel{2}}\left(\frac{72-6x^2}{4\cancel{x}}\right)$$

$$V = \frac{1}{4}(72x-6x^3) = 18x - \frac{3}{2}x^3 = x\left(18-\frac{3}{2}x^2\right)$$

general shape

if $V=0$, then $x=0$ or $18 = \frac{3}{2}x^2$
$12 = x^2$
$x = \pm 2\sqrt{3}$ (but $x=-2\sqrt{3}$ is not reasonable here)



only consider this piece of graph where $V>0$ $\Rightarrow$ $0 < x < 2\sqrt{3}$

x	V
$\sqrt{3}$	23.38
1	16.5
1.8	23.652
1.9	23.9115
2.3	23.1495
2	24
2.1	23.9085

max volume at about $x = 2$ ft

$$\Rightarrow h = \frac{72-6(4)}{8} = 6\text{ ft}$$