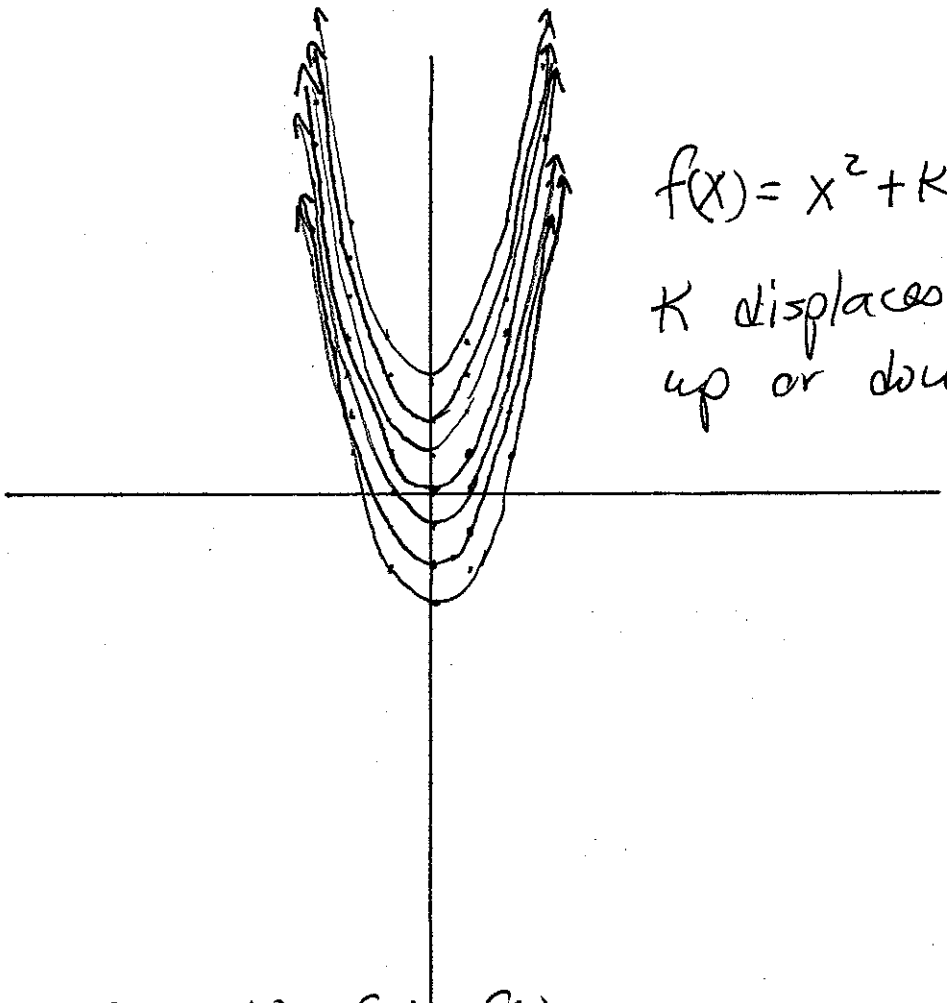
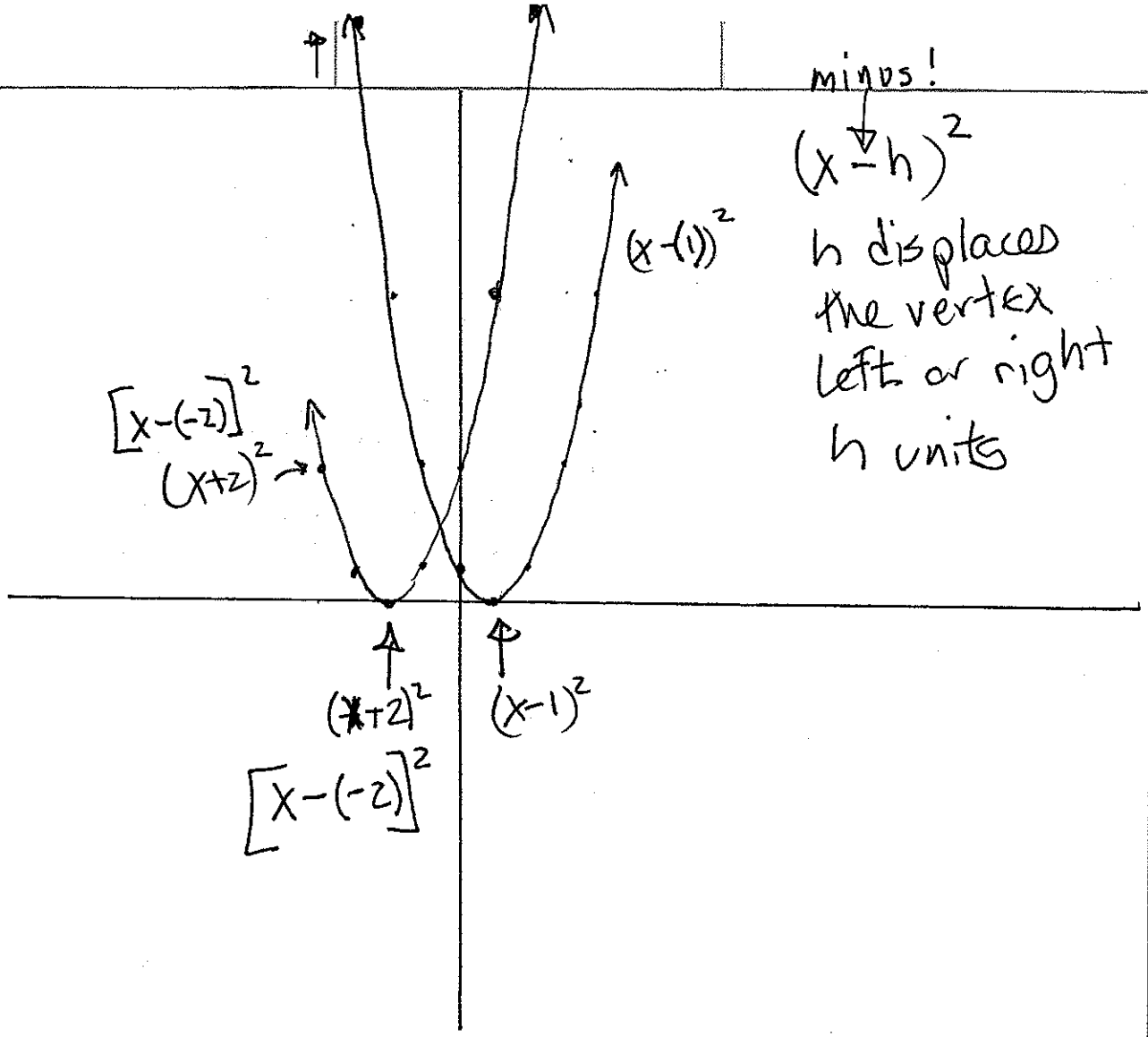


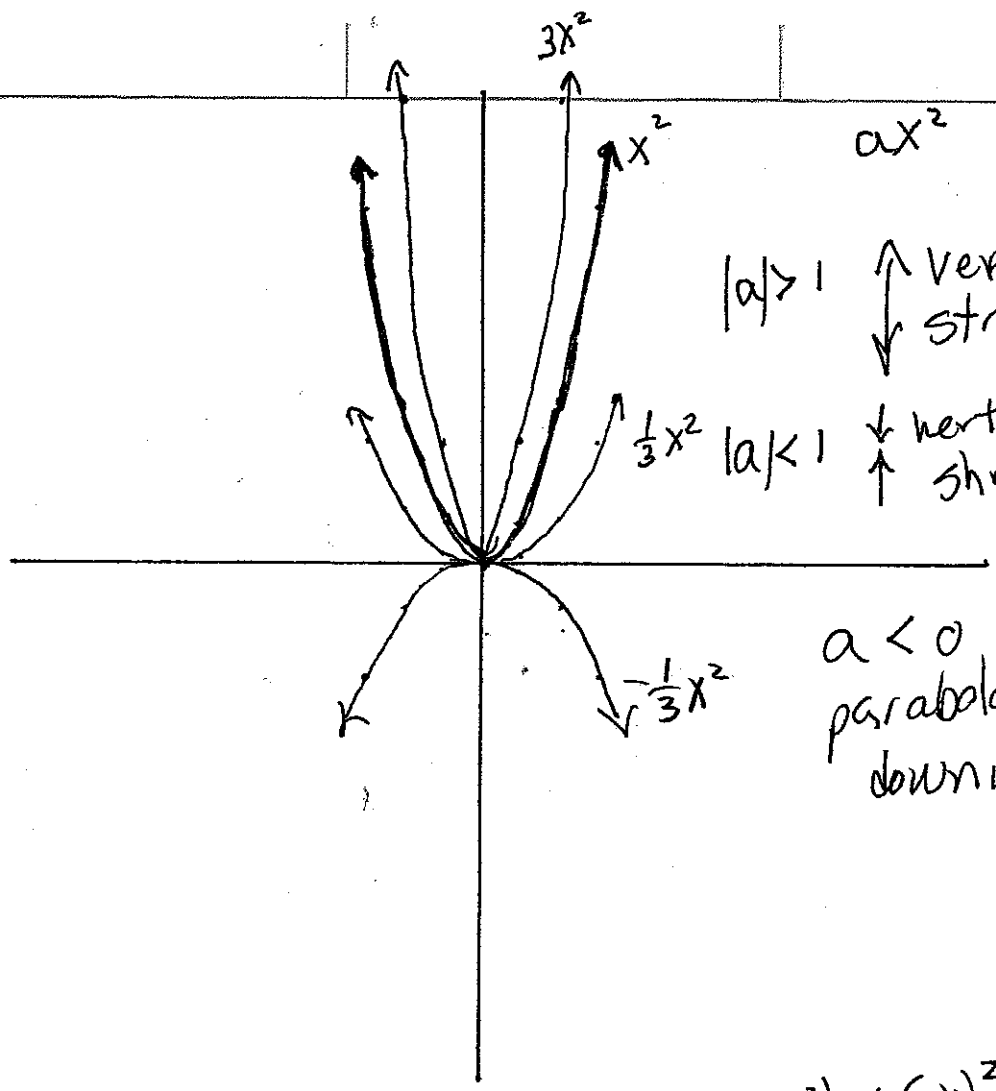
$f(x) = x^2 + K$

K displaces vertex up or down

| x | $x^2$ | $x^2+1$ | $x^2+2$ | $x^2+3$ | $x^2-1$ | $x^2-2$ | $x^2-3$ |
|---|---|---|---|---|---|---|---|
| -3 | 9 | 10 | 11 | 12 | 8 | 7 | 6 |
| -2 | 4 | 5 | 6 | 7 | 3 | 2 | 1 |
| -1 | 1 | 2 | 3 | 4 | 0 | -1 | -2 |
| 0 | 0 | 1 | 2 | 3 | -1 | -2 | -3 |
| 1 | 1 | 2 | 3 | 4 | 0 | -1 | -2 |
| 2 | 4 | 5 | 6 | 7 | 3 | 2 | 1 |
| 3 | 9 | 10 | 11 | 12 | 8 | 7 | 6 |




| x | $(x+1)^2$ | $(x+2)^2$ | $(x+3)^2$ | $(x-1)^2$ | $(x-2)^2$ | $(x-3)^2$ |
|---|---|---|---|---|---|---|
| -4 | 9 | 4 | 1 | 25 | 36 | 49 |
| -3 | 4 | 1 | 0 | 16 | 25 | 36 |
| -2 | 1 | 0 | 1 | 9 | 16 | 25 |
| -1 | 0 | 1 | 4 | 4 | 9 | 16 |
| 0 | 1 | 4 | 9 | 1 | 4 | 9 |
| 1 | 4 | 9 | 16 | 0 | 1 | 4 |
| 2 | 9 | 16 | 25 | 1 | 0 | 1 |
| 3 | 16 | 25 | 36 | 4 | 1 | 0 |
| 4 | 25 | 36 | 49 | 9 | 4 | 1 |




$ax^2$

$|a|>1$ ↑↓ vertical stretch

$|a|<1$ ↓↑ vertical shrink

$a<0$ parabola open downward ↓

$-x^2 = -(x^2) \neq (-x)^2$

| $x$ | $x^2$ | $3x^2$ | $\frac{1}{3}x^2$ | $-x^2$ | $-3x^2$ | $-\frac{1}{3}x^2$ |
|---|---|---|---|---|---|---|
| -3 | 9 | 27 | 3 | -9 | -27 | -3 |
| -2 | 4 | 12 | $\frac{4}{3}$ | -4 | -12 | $-\frac{4}{3}$ |
| -1 | 1 | 3 | $\frac{1}{3}$ | -1 | -3 | $-\frac{1}{3}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 3 | $\frac{1}{3}$ | -1 | -3 | $-\frac{1}{3}$ |
| 2 | 4 | 12 | $\frac{4}{3}$ | -4 | -12 | $-\frac{4}{3}$ |
| 3 | 9 | 27 | 3 | -9 | -27 | -3 |