# PreCalc 11 Final Review Chp 4

Note Title 2016-05-25

## 4.1) Properties

Quadratic functions must have:
- a vertex at min or max (y-values)
- axis of symmetry at vertex ($x=p$ or avg of x-ints)
- a y-int ($x=0$ or $y=c$ if general form)
- domain ($x \in \mathbb{R}$) $\in$ element of
- zeroes (if they exist) are x-ints.
- is concave up ($a>0$) or down ($a<0$)

General form: $y = ax^2+bx+c$

Standard/Vertex form: $y = a(x-p)^2+q$

Factored form: $y = a(x-d)(x-e)$

Graphing: Start at vertex; over 1 grid unit, then up/down by a(odd numbers):

eg) 1, 3, 5, 7, ... or 2(1, 3, 5, 7, ...) = 2, 6, 10, 14, ...

## 4.2) Graphing: Window $X \in [-c, c]$ $y \in [-c, c]$

make range bigger if lines are vertical

" smaller " horizontal

## 4.3) Transforming: $y = a(x-p)^2+q$

$|a| > 1$ is vert stretch (VS)

$|a| < 1$ " compression (VC)

$a < 0$ is vert reflection/flip on x-axis.

$p > 0$ shift right

$p < 0$ shift left.

$q > 0$ " up

$q < 0$ " down.

When graphing more than one function, use thick line for $y_2$

## 4.4) Finding Equations.

1. Find vertex $(p,q)$
2. Substitute into $y=a(x-p)^2+q$
3. Subst any point except vertex and solve for 'a'.

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1. Given 'a'
2. Subst into $y=a(x-p)^2+q$
3. Subst a known point for eqn 1.
4. " another " eqn 2.
5. Solve system of linear equations using substitution or elimination

eg) $a=-2$ $P_1=(-1,4)$ $P_2=(2,-26)$

$y=-2(x-p)^2+q$

$4=-2(-1-p)^2+q$

$4+2(p+1)^2=q$

$4+2(p^2+2p+1)=q$

$2p^2+4p+6=q$

$2(-2)^2+4(-2)+6=q$

$8-8+6=q$

$q=6$

$-26=-2(2-p)^2+q$

$-26=-2(p^2-4p+4)+2p^2+4p+6$

$-26=-2p^2+8p-8+2p^2+4p+6$

$-26=12p$

$-24=12p$

$p=-2$

$y=-2(x+2)^2+6$

## 4.5) Properties (2)

| | $y=ax^2+bx+c$ | $y=a(x-p)^2+q$ | $y=a(x-d)(x-e)$ |
|---|---|---|---|
| vertex | | $(p,q)$ | |
| AoS | $x=-b/2a$ | $x=p$ | $x=\frac{d+e}{2}$ |
| # of x-ints | check $b^2-4ac$ | check $a\cdot q$ | check d, e. |
| y-int | $c$ | subst $x=0$ → | |
| concavity | $a$ → | | |
| min/max | | $a>0$, min $=q$; $a<0$, max $=q$ → | |
| domain | $x\in\mathbb{R}$ → | | |
| range | | $a>0$, $y\geq q$; $a<0$, $y\leq q$ | |

## 4.6) Modelling Functions: Choose vertex at origin is usually the easiest $p=0$, $q=0$. Then substitute know point except $(0,0)$ to solve for 'a'.

4.7) Modelling (2)

- draw a diagram
- write relations in terms of the answer variable
- copy formulas from notes