Chapter 1

Interval notation:

( ) when >

∞ uses (they never stop)

[ ] when ≥

∞ uses

Sign chart:

\[(a+b)(c-d) ≥ 0\]

\[a+b = e\]

\[c-d = f\]

\[(a+b)(c-d) = \frac{e}{f} + \frac{0}{f} + \frac{0}{f} + \frac{+}{f} + \frac{-}{f} + \frac{0}{f} + \frac{+}{f}\]

\[(x,y) (x,y)\]

\[x ≤ 0 \quad y ≥ 0\]

Absolute value properties:

1. \(|a| = |a| (a \text{ special case of 3.)}

2. \(|a| = 0\) *For the point (x,y)

3. \(|ab| = |a||b|\)

4. \(|\frac{a}{b}| = |a| |b|\)

5. \(|a+b| ≤ |a| + |b| \sim |a+b| ≠ |a| |b|\)

Honestly, we never use 5. in Precal.

Absolute value really means dist. from the origin.

Don't forget: \(|A| = \begin{cases} A & \text{if } A ≥ 0 \\ -A & \text{if } A < 0 \end{cases}\)

Absolute values & inequalities

\(|x| < a \text{ if } -a < x < a\)

\(|x| > a \text{ if } -a > x > a \text{ (should use "or")}\)

Distance formula: \(\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}\)

Midpoint formula: \(\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)\) * this is the average
formula for a circle: \((x-h)^2 + (y-k)^2 = r^2\)

\(h,k\) = center

\(r\) = radius

completing the square: \(x^2 + y^2 + 10x - 2y + 17 = 0\)

1. Separate x’s & y’s & move constant to other side
\((x^2 + 10x + 25) + (y^2 - 2y + 1) = -17 + 25 + 1\)

2. Take \(\frac{1}{2}\) of unsquared term’s coefficient & square
\(x^2 = 25\) \(y^2 = 1\)

3. Add to both sides
\((x^2 + 10x + 25) + (y^2 - 2y + 1) = -17 + 25 + 1\)

4. Factor
\((x + 5)^2 + (y - 1)^2 = 9\)

center = \((-5, 1)\)

radius = 3

semicircles:

\(y = \sqrt{r^2 - x^2}\) \(y = \sqrt{r^2 - x^2}\) \(x = \sqrt{r^2 - y^2}\) \(x = \sqrt{r^2 - y^2}\)

(The 4 formulas above are true only in case the center is \((0, 0)\).)

intercepts:

\(x\)-int \~ Set \(y = 0\)

\(y\)-int \~ Set \(x = 0\)
symmetry: Probably not my wording, but good for you.

\[
y\text{-axis if } -x \text{ yields same results as } x \\
x\text{-axis if } -y \text{ yields same results as } y \\
\text{origin if } -x,-y \text{ yields same results as } x,y
\]

factorizations:
\[
a^3-b^3 = (a-b)(a^2+ab+b^2) \\
a^3+b^3 = (a+b)(a^2-ab+b^2)
\]

Pascal's triangle:  

\[
\begin{array}{ccccccc}
& & & & x^n & & \\
& & & 1 & & & \\
& & 1 & & 1 & & \\
(a+b)^2 & 1 & 2 & 1 \\
& 1 & 3 & 3 & 1 \\
(a+b)^3 & 1 & 4 & 6 & 4 & 1 \\
& & & & & & \\
\end{array}
\]

\[
(x+y)^n = \binom{n}{0}x^n + \binom{n}{1}x^{n-1}y + \binom{n}{2}x^{n-2}y^2 + \ldots + \binom{n}{n-1}xy^{n-1} + \binom{n}{n}y^n
\]

So, for example, \((a+b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4\)

limits:
\[
\lim_{x\to1} \frac{nx^n}{n^x} \text{ just get whatever makes } x=1 \text{ out & solve}
\]

That is, factor \((x-1)\) out of \(\text{top} \div \text{bottom, cancel, then } \text{let } x=1.\)

Chapter 2:

domain = all the real x's at which \(f(x)\) is defined = the set of all x-values on ...

range = all the real y's = set of all y-values on ...

vertical line test: if every vertical line crosses the graph 

0 or 1 time only once, the graph is a graph of a function.

Curve fails VLT when some vertical line intersects the graph more than once.
symmetry in functions:
even \quad y\text{-axis if } f(x) = f(-x)
odd \quad \text{origin if } f(x) = -f(-x)

vertical & horizontal shifts:

\begin{align*}
f(x)+c &= \uparrow \\
f(x)-c &= \downarrow \\
f(x+c) &= \leftarrow \\
f(x-c) &= \rightarrow \\
\end{align*}

vertical stretches & compressions: $cf(x)$

- stretched if $c > 1$
- compressed if $0 < c < 1$

linear functions:

- point-slope form $y - y_1 = m(x - x_1)$
- slope-intercept form $y = mx + b$

parallel if $m_1 = m_2$
perpendicular if $m_1 = -\frac{1}{m_2}$

quadratic functions:

\begin{align*}
f(x) &= ax^2 + bx + c \\
\text{std. form} f(x) &= a(x-h)^2 + k
\end{align*}

- vertex $x = -\frac{b}{2a}$
- Axis of symmetry is $x = -\frac{b}{2a}$
- $y$-coordinate of vertex ($=k$) is the maximum value of $f$ if $a < 0$, and minimum if $a > 0$
intercepts:
1. $b^2 - 4ac > 0$ then 2 real
2. $b^2 - 4ac = 0$ then 1 double
3. $b^2 - 4ac < 0$ then no real

graphs of $y = x^{\frac{m}{n}}$:
- if $n$ is even it'll be in I & that's all
- if $n$ is odd & $m$ is even it'll be in I & II
- if they are both odd it'll be in I & III
- if $\frac{m}{n} > 1$ then I is \[ \]
- if $0 < \frac{m}{n} < 1$ then I is \[ \]
- if $\frac{m}{n} < 0$ then I is \[ \]