**Chapter 10 – Topics in Analytic Geometry**

**PreCalculus 10.1 Lines**

**Equation of a line:**

 $y=mx+b$ *m* = slope, *b* = *y*-intercept

**Inclination**: the positive angle (between 0° and 180°) measured counterclockwise from the *x*-axis to the line.

Examples:

$$\frac{π}{2}$$

142°

32°

**Inclination and Slope**

 If a non-vertical line has inclination $θ$ and slope *m*, then

 $m=\tan(θ)$

**Finding the Inclination of a Line**

 Ex: Find the inclination of the line: $\sqrt{3} x-3y+3=0$

 $\sqrt{3} x-3y+3=0$ $m=\frac{\sqrt{3}}{3}$

 $\sqrt{3} x +3=3y$ $\frac{\sqrt{3}}{3}= \tan(θ)$

 $θ=tan^{-1}\left(\frac{\sqrt{3}}{3}\right)$

 $y=\frac{\sqrt{3}}{3} x+1$

 $θ=30°$ or $\frac{π}{6}$ radians

Ex: Find the inclination of the line: $2x+3y=6$

**Angle Between Two Lines**

 If two non-perpendicular lines have slopes $m\_{1}$ and $m\_{2}$, the angle between the lines is:

 $\tan(θ)=\left|\frac{m\_{1}-m\_{2}}{1+m\_{1}m\_{2}}\right|$

Ex: Finding the angle between two lines:

 Line 1: $2x+y=4$ Line 2: $x-y=2$

 $ y=-2x+4$ $x-2=y$

 $m\_{1}=-2$ $m\_{2}=1$

 $\tan(θ)=\left|\frac{-2-1}{1+\left(-2\right)\left(1\right)}\right|$

 $\tan(θ)=\left|\frac{-3}{-1}\right|$

 $\tan(θ)=3$ $θ=tan^{-1}\left(3\right) ≈ 1.249 radians$ (or $71.6°$)

Example: Find the angle between the lines:

 $5x+3y=8$

 $x-4y=-2$

**The Distance Between a Point and a Line**

 The distance between a point $\left(x\_{1}, y\_{1}\right)$ and the line $Ax+By+C=0$ is:

 $d=\frac{\left|Ax\_{1}+By\_{1}+C\right|}{\sqrt{A^{2}+B^{2}}}$

Example: Find the distance between the point $\left(5, -3\right)$ and the line $y=-x+3$

 $\left(x\_{1}, y\_{1}\right)\rightarrow \left(5, -3\right)$ $y=-x+3$

 $x+y-3=0$

 $A=1$ $B=1$ $C=-3$

 $d=\frac{\left|1\left(5\right)+1\left(-3\right)-3\right|}{\sqrt{1^{2}+1^{2}}}$

 $d=\frac{\left|-1\right|}{\sqrt{2}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$ units

Example: Find the distance between the point $\left(2, 0\right)$ and the line $4x+3y=0$