$\int u\,dv = uv - \int v\,du$

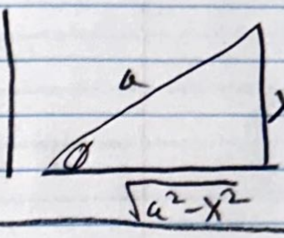
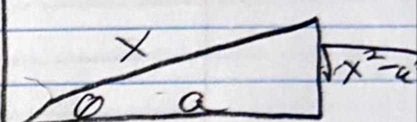
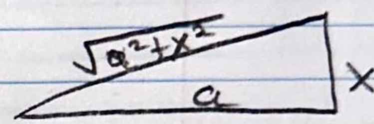
$u =$ function of $u(x)$

$dv =$ variable dv

$v =$ function of $v(x)$

$du =$ variable du

$\frac{du}{1+u^2} = \arctan(u)$

$\sqrt{a^2-x^2}$ identity $= 1-\sin^2\theta = \cos^2\theta$	$x = a\sin\theta$ $\sqrt{a^2-x^2} = a\cos\theta$	
$\sqrt{x^2-a^2}$ $\sec^2\theta - 1 = \tan^2\theta$	$x = a\sec\theta$ $\sqrt{x^2-a^2} = a\tan\theta$	
$\sqrt{a^2+x^2}$ $1+\tan^2\theta = \sec^2\theta$	$x = a\tan\theta$ $\sqrt{a^2+x^2} = a\sec\theta$	

1) linear homoguence

$$y' + p(x)y = 0 \rightarrow y = Ce^{-\int p(x)dx}$$

2) linear non-homoguence

$y' + p(x)y = f(x) \rightarrow$ <u>Step 1</u> - y_1 if any solution of assoc homog

<u>Step 2</u> - $y = u \cdot y_1$

$u' = \frac{f(x)}{y_1}$

3) Seperable $h(y)y' = g(x)$ - Intergrate both side w.r.t. x

4) Bernoulli - $y' + p(x)y = f(x)y^r \rightarrow$ <u>Step 1</u> - y_1 is any solution of associated homoge equ.

<u>Step 2</u> - $y = uy_1$

$\frac{u'}{r'} = f(x)y_1^{r-1}$

5) Non-linear homogeneous

$y' = f(x,y)$ where $f(x,y)$ depends on $y/x = u$ $= q(u)$

Step 1 - $y_1 = x$, Step 2 - $y = uy_1 = ux$, $\frac{u'}{q(u)-u} = \frac{1}{x}$