

$\sin 2\theta$
 - reduce $\sin 2\theta$ with $2\sin\theta\cos\theta$
 - factor out GCF

$\cos 2\theta$
 - replace $\cos 2\theta$ with
 $2\cos^2\theta - 1$ if $\cos\theta$ involved
 $1 - 2\sin^2\theta$ if $\sin\theta$ involved

	30	45	60			
sin	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	0	1	0
cos	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	1	0	-1
tan	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	0	0	0

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Date _____
 Algebra II

Double Angle Trig Equations

Solve the following equations to the nearest degree in the interval $0^\circ \leq \theta < 360^\circ$.

1. $3\cos\theta + \sin 2\theta = 0$

$x = \cos\theta$
 $y = \sin\theta$

$3\cos\theta + 2\sin\theta\cos\theta = 0$

$3x + 2yx = 0$

$x(3 + 2y) = 0$

$x = 0$
 $\cos\theta = 0$
 $\theta = 90^\circ, 270^\circ$

$3 + 2y = 0$
 $2y = -3$
 $y = -\frac{3}{2}$
 $\sin\theta = -\frac{3}{2}$
 NS

2. $\sin 2\theta + \sqrt{2}\cos\theta = 0$

$x = \sin\theta$
 $y = \cos\theta$

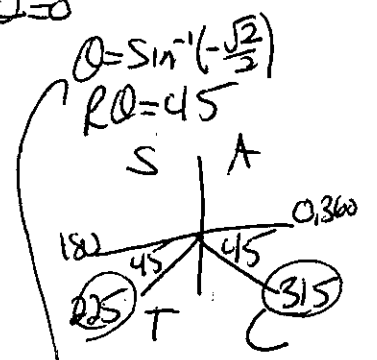
$2\sin\theta\cos\theta + \sqrt{2}\cos\theta = 0$

$2xy + \sqrt{2}y = 0$

$y(2x + \sqrt{2}) = 0$

$y = 0$
 $\cos\theta = 0$
 $\theta = 90^\circ, 270^\circ$

$2x + \sqrt{2} = 0$
 $2x = -\frac{\sqrt{2}}{2}$
 $x = -\frac{\sqrt{2}}{2}$
 $\sin\theta = -\frac{\sqrt{2}}{2}$
 $\theta = 225^\circ, 315^\circ$



$\theta = 90^\circ, 225^\circ, 270^\circ, 315^\circ$

3. $\sin 2\theta + \sin\theta = 0$

$x = \sin\theta$
 $y = \cos\theta$

$2\sin\theta\cos\theta + \sin\theta = 0$
 $\theta = 0^\circ, 180^\circ, 180^\circ, 360^\circ$

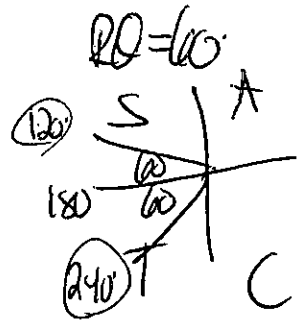
$2xy + x = 0$

$x(2y + 1) = 0$

$x = 0$
 $\sin\theta = 0$
 $\theta = 0^\circ, 180^\circ$

$2y + 1 = 0$
 $2y = -1$
 $y = -\frac{1}{2}$
 $\cos\theta = -\frac{1}{2}$
 $\theta = 120^\circ, 240^\circ$

$2y + 1 = 0$
 $2y = -1$
 $y = -\frac{1}{2}$
 $\cos\theta = -\frac{1}{2}$
 $\theta = 120^\circ, 240^\circ$



4. $\sin 2\theta = \sin\theta$

$x = \sin\theta$
 $y = \cos\theta$

$2\sin\theta\cos\theta = \sin\theta$

$2xy = x$
 $-x = -x$

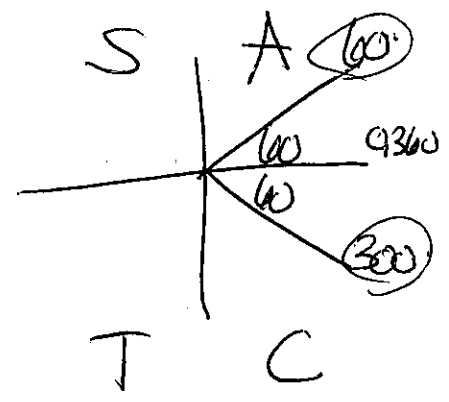
$2xy - x = 0$

$x(2y - 1) = 0$

$x = 0$
 $\sin\theta = 0$
 $\theta = 0^\circ, 180^\circ$

$2y - 1 = 0$
 $2y = 1$
 $y = \frac{1}{2}$
 $\cos\theta = \frac{1}{2}$
 $\theta = 60^\circ, 300^\circ$

$2y - 1 = 0$
 $2y = 1$
 $y = \frac{1}{2}$
 $\cos\theta = \frac{1}{2}$
 $\theta = 60^\circ, 300^\circ$



$\theta = 0^\circ, 60^\circ, 180^\circ, 300^\circ$

$\cos 2\theta = 2\cos^2\theta - 1$ if $\cos\theta$ is involved
 $\cos 2\theta = 1 - 2\sin^2\theta$ if $\sin\theta$ is involved

5. $\cos\theta = 2 + 3\cos 2\theta$

$\cos\theta = 2 + 3(2\cos^2\theta - 1)$

$\cos\theta = 2 + 3(2x^2 - 1)$

$x = 2 + 6x^2 - 3$

$0 = 6x^2 - x - 1$

$6x^2 - 3x + 2x - 1$

$3x(2x-1) + 1(2x-1)$

$0 = (3x+1)(2x-1)$

$3x+1=0 \quad 2x-1=0$

$\frac{3x}{3} = \frac{-1}{3} \quad \frac{2x}{2} = \frac{1}{2}$

7. $\cos 2\theta + \cos\theta = -1$

$2\cos^2\theta - 1 + \cos\theta = -1$

$x = \cos\theta \quad 2x^2 - 1 + x = -1$

$2x^2 + x = 0$

$x(2x+1) = 0$

$x=0 \quad 2x+1=0$

$\cos\theta = 0 \quad 2x = -\frac{1}{2}$

$\theta = \cos^{-1}(0) \quad x = -\frac{1}{2}$

$\theta = 90^\circ, 270^\circ$

$\cos\theta = -\frac{1}{2}$

$\theta = \cos^{-1}(-\frac{1}{2})$

$\theta = 120^\circ$

$\theta = 90^\circ, 120^\circ, 240^\circ, 270^\circ$

$x = \frac{1}{3} \quad x = \frac{1}{2} \quad 3\cos 2\theta + 2\sin\theta = -1$

$\cos\theta = \frac{1}{3} \quad \cos\theta = \frac{1}{2}$

$\theta = \cos^{-1}(\frac{1}{3}) \quad \theta = \cos^{-1}(\frac{1}{2})$

$\theta = 71^\circ \quad \theta = 60^\circ$

$\theta = 109^\circ$

$\theta = 251^\circ$

$\theta = 300^\circ$

$\theta = 300^\circ$

$\theta = 300^\circ$

$\theta = 300^\circ$

$\theta = 300^\circ$

$\theta = 60^\circ, 109^\circ, 251^\circ, 300^\circ$

$x = \sin\theta$

$3(1 - 2\sin^2\theta) + 2\sin\theta = -1$

$3(1 - 2x^2) + 2x = -1$

$3 - 6x^2 + 2x = -1$

$-6x^2 + 2x + 4 = 0$

$3x^2 - x - 2 = 0$

$3x^2 - 3x + 2x - 2$

$3x(x-1) + 2(x-1)$

$(3x+2)(x-1) = 0$

$3x+2=0 \quad x-1=0$

$\frac{3x}{3} = \frac{-2}{3} \quad x = 1$

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$x = \frac{2}{3} \quad x = 1$

$\sin\theta = \frac{2}{3} \quad \sin\theta = 1$

$\theta = \sin^{-1}(\frac{2}{3}) \quad \theta = \sin^{-1}(1)$

$\theta = 42^\circ \quad \theta = 90^\circ$

$\theta = 42^\circ$

$\theta = 222^\circ$

$\theta = 90^\circ, 222^\circ, 318^\circ$

8. $\cos 2\theta + 3\cos\theta + 2 = 0$

$2\cos^2\theta - 1 + 3\cos\theta + 2 = 0$

$2x^2 - 1 + 3x + 2 = 0$

$2x^2 + 3x + 1 = 0$

$2x^2 + 2x + 1x + 1$

$2x(x+1) + 1(x+1)$

$(2x+1)(x+1) = 0$

$2x+1=0 \quad x+1=0$

$\frac{2x}{2} = \frac{-1}{2} \quad x = -1$

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$x = \cos\theta$

$\theta = 120^\circ$

$\theta = 240^\circ$

$\theta = 120^\circ, 240^\circ$

$\theta = 120^\circ, 180^\circ, 240^\circ$

$\theta = 120^\circ, 180^\circ, 240^\circ$

$\theta = 120^\circ, 180^\circ, 240^\circ$

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$\theta = 120^\circ, 180^\circ, 240^\circ$

$$x = \cos \theta$$

$$9. 3 \cos 2\theta = \cos \theta + 2$$

$$3(2 \cos^2 \theta - 1) = \cos \theta + 2$$

$$3(2x^2 - 1) = x + 2$$

$$6x^2 - 3 = x + 2$$

$$-x - 2 \quad -x - 2$$

$$6x^2 - x - 5 = 0$$

$$6x^2 - 6x + 5x - 5$$

$$6x(x-1) + 5(x-1)$$

$$(6x+5)(x-1) = 0$$

$$6x+5=0 \quad x-1=0$$

$$6x = -5 \quad x = 1$$

$$11. 3 \cos 2\theta + 5 = -8 \sin \theta \quad x = \sin \theta$$

$$3(1 - 2 \sin^2 \theta) + 5 = -8 \sin \theta$$

$$3(1 - 2x^2) + 5 = -8x$$

$$3 - 6x^2 + 5 = -8x$$

$$-6x^2 + 8x + 8 = 0$$

$$-2 \quad -2 \quad -2 \quad -2$$

$$3x^2 - 4x - 4 = 0$$

$$3x^2 - 6x + 2x - 4$$

$$3x(x-2) + 2(x-2)$$

$$(3x+2)(x-2) = 0$$

$$3x+2=0 \quad x-2=0$$

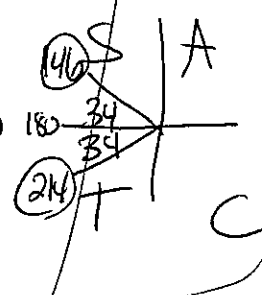
$$\frac{3x}{3} = -\frac{2}{3} \quad x = 2$$

$$x = -\frac{2}{3} \quad \sin \theta = -\frac{2}{3} \quad \theta = \sin^{-1}(-\frac{2}{3})$$

$$x = -\frac{5}{6} \quad x = 1$$

$$\theta = \cos^{-1}(-\frac{5}{6}) \quad \theta = \cos^{-1}(1)$$

$$R\theta = 34^\circ \quad \theta = 0$$



$$\theta = 0, 146, 214$$

$$x = \cos \theta$$

$$10. \cos 2\theta - \cos \theta = 0$$

$$2 \cos^2 \theta - 1 - \cos \theta = 0$$

$$2x^2 - 1 - x = 0$$

$$2x^2 - 2x + 1x - 1$$

$$2x(x-1) + 1(x-1) = 0$$

$$(2x+1)(x-1) = 0$$

$$2x+1=0 \quad x-1=0$$

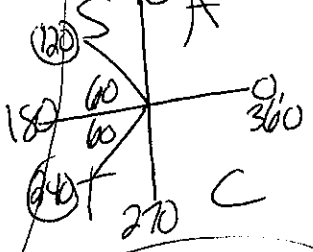
$$\frac{2x}{2} = -\frac{1}{2} \quad x = 1$$

$$x = -\frac{1}{2}$$

$$\cos \theta = \frac{1}{2} \quad \cos \theta = 1$$

$$\theta = \cos^{-1}(\frac{1}{2}) \quad \theta = \cos^{-1}(1)$$

$$R\theta = 60 \quad \theta = 0$$



$$\theta = 0, 120, 240$$

$$12. 3 \cos 2\theta + 5 \cos \theta = -2 \quad x = \cos \theta$$

$$3(2 \cos^2 \theta - 1) + 5 \cos \theta = -2$$

$$3(2x^2 - 1) + 5x = -2$$

$$6x^2 - 3 + 5x = -2$$

$$6x^2 + 5x - 1 = 0$$

$$6x^2 + 6x - 1x - 1$$

$$6x(x+1) - 1(x+1) = 0$$

$$(6x-1)(x+1) = 0$$

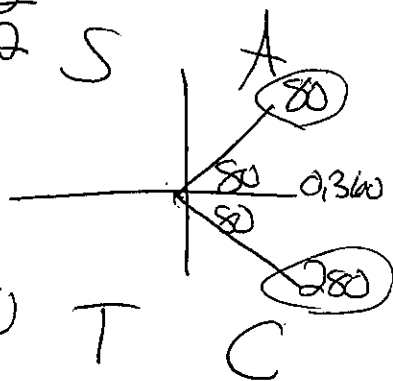
$$6x-1=0 \quad x+1=0$$

$$\frac{6x}{6} = \frac{1}{6} \quad x = -1$$

$$x = \frac{1}{6} \quad \cos \theta = -1$$

$$\cos \theta = \frac{1}{6} \quad \theta = \cos^{-1}(\frac{1}{6})$$

$$R\theta = 80 \quad \theta = 180$$



$$\theta = 80, 180, 280$$

