8.5.1

$r = 3\sec\theta$

$r = \frac{3}{\cos\theta}$

$r \cdot \cos\theta = 3$

$x = 3$

Loddrett linje gjennom $x=3$

8.5.2

$r = -2\csc\theta$

$r = -\frac{2}{\sin\theta}$

$r \cdot \sin\theta = -2$

$y = -2$

Horisontal linje gjennom $y=-2$

8.5.3

$r = \frac{5}{3\sin\theta - 4\cos\theta}$

$3r\sin\theta - 4r\cos\theta = 5$

$3y - 4x = 5$

$3y = 4x + 5$

$y = \frac{4}{3}x + \frac{5}{3}$

Rett linje med stigningstall $\frac{4}{3}$ og konstantledd $\frac{5}{3}$

8.5.4

$r = \sin\theta + \cos\theta$

$r^2 = r\sin\theta + r\cos\theta$

$x^2 + y^2 = y + x$

$x^2 - x + y^2 - y = 0$

$\left(x + \frac{-1}{2}\right)^2 - \frac{(-1)^2}{4} + \left(y + \frac{-1}{2}\right)^2 - \frac{(-1)^2}{4} = 0$

$\left(x - \frac{1}{2}\right)^2 + \left(y - \frac{1}{2}\right)^2 = \left(\sqrt{\frac{1}{2}}\right)^2$

Sirkel med senter i $(\frac{1}{2}, \frac{1}{2})$ og radius $\sqrt{\frac{1}{2}}$.

8.5.5

$r^2 = \csc 2\theta$

$r^2 = \frac{1}{\sin 2\theta} = \frac{1}{2\sin\theta \cdot \cos\theta}$

$r \cdot \sin\theta \cdot r \cdot \cos\theta = \frac{1}{2}$

$x \cdot y = \frac{1}{2}$

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

Hyperbel

8.5.6

$r = \sec\theta \cdot \tan\theta$

$r = \frac{1}{\cos\theta} \cdot \frac{\sin\theta}{\cos\theta}$

$r^2 \cdot \cos^2\theta = r \cdot \sin\theta$

$x^2 = y$

parabel

8.5.7

$r = \sec\theta(1+\tan\theta)$

$r = \frac{1}{\cos\theta}\left(1 + \frac{\sin\theta}{\cos\theta}\right)$

$r\cos\theta = 1 + \frac{\sin\theta}{\cos\theta}$

$r\cos^2\theta = \cos\theta + \sin\theta$

$r^2\cos^2\theta = r\cos\theta + r\sin\theta$

$x^2 = x + y$

$y = x^2 - x$

parabel

8.5.8

$r = \frac{2}{\sqrt{\cos^2\theta + 4\sin^2\theta}}$

$r^2\cos^2\theta + 4r^2\sin^2\theta = 4$

$x^2 + 4y^2 = 4$

$\frac{x^2}{2^2} + \frac{y^2}{1^2} = 1$

Ellipse

8.5.9

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

$r - r\cos\theta = 1$

$r - x = 1$

$r = x + 1$

$r^2 = (x+1)^2$

$x^2 + y^2 = (x+1)^2$

$x^2 + y^2 = x^2 + 2x + 1$

$y^2 = 2x + 1$

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

parabel

8.5.10

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

$2r - r\cos\theta = 2$

$2r - x = 2$

$2r = x + 2$

$4r^2 = (x+2)^2$

$4(x^2+y^2) = x^2 + 4x + 4$

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

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

$3\left(x + \frac{-4}{2\cdot 3}\right)^2 - \frac{(-4)^2}{4\cdot 3} + 4y^2 - 4 = 0$

$3\left(x - \frac{2}{3}\right)^2 + 4y^2 = \frac{16}{3}$

$\frac{\left(x - \frac{2}{3}\right)^2}{\left(\frac{4}{3}\right)^2} + \frac{y^2}{\left(\frac{2}{\sqrt{3}}\right)^2} = 1$

Ellipse

8.5.11

$$r = \frac{2}{1-2\sin\theta}$$

$$r - 2r\sin\theta = 2$$

$$r - 2y = 2$$

$$r = 2 + 2y = 2(y+1)$$

$$r^2 = 4(y+1)^2$$

$$x^2 + y^2 = 4(y^2 + 2y + 1)$$

$$x^2 + y^2 - 4y^2 - 8y - 4 = 0$$

$$x^2 - 3y^2 - 8y - 4 = 0$$

$$x^2 - 3\left(y + \frac{-8}{2\cdot(-3)}\right)^2 - \frac{(-8)^2}{4\cdot(-3)} - 4 = 0$$

$$x^2 - 3\left(y + \frac{4}{3}\right)^2 = -\frac{4}{3}$$

$$\frac{\left(y + \frac{4}{3}\right)^2}{\left(\frac{2}{3}\right)^2} - \frac{x^2}{\left(\frac{2}{\sqrt{3}}\right)^2} = 1$$

Hyperbel

8.5.12

$$r = \frac{2}{1+\sin\theta}$$

$$r + r\sin\theta = 2$$

$$r^2 = (2-y)^2$$

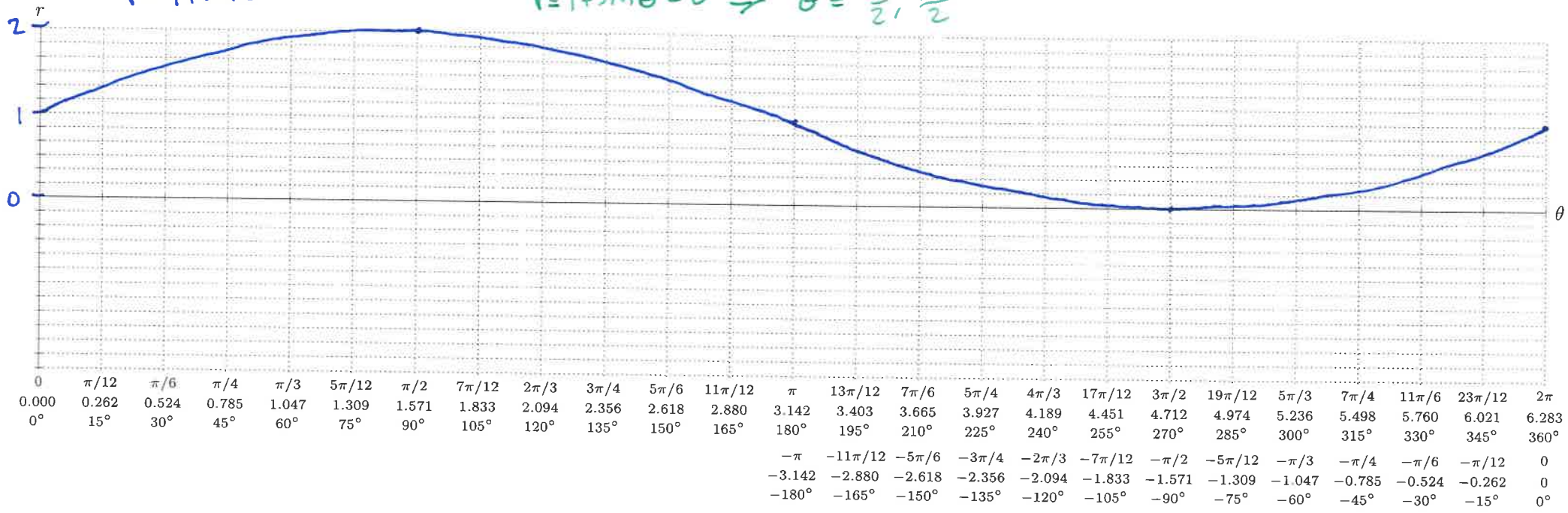
$$x^2 + y^2 = 4 - 4y + y^2$$

$$x^2 = 4 - 4y$$

parabel

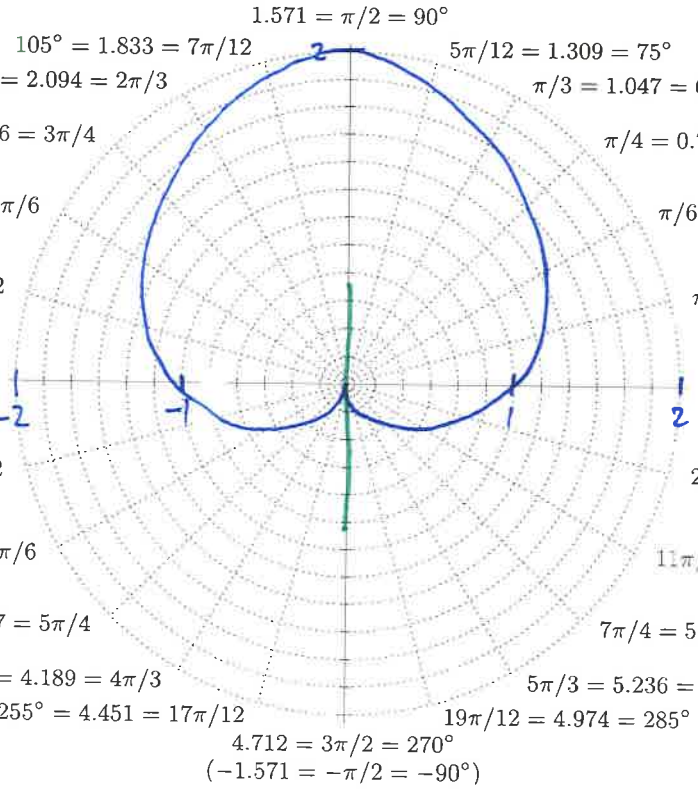
$r = 1 + \sin\theta$

$r = 1 + \sin\theta = 0 \Rightarrow \theta = \frac{\pi}{2}, \frac{3\pi}{2}$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
0.000	0.262	0.524	0.785	1.047	1.309	1.571	1.833	2.094	2.356	2.618	2.880	3.142	3.403	3.665	3.927	4.189	4.451	4.712	4.974	5.236	5.498	5.760	6.021	6.283
0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	360°

$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°



$1.571 = \pi/2 = 90°$

$105° = 1.833 = 7\pi/12$

$5\pi/12 = 1.309 = 75°$

$120° = 2.094 = 2\pi/3$

$\pi/3 = 1.047 = 60°$

$135° = 2.356 = 3\pi/4$

$\pi/4 = 0.785 = 45°$

$150° = 2.618 = 5\pi/6$

$\pi/6 = 0.524 = 30°$

$165° = 2.880 = 11\pi/12$

$\pi/12 = 0.262 = 15°$

$(-180° = -3.142 = -\pi)$ $180° = 3.142 = \pi$

$0 = 0°$

$2\pi = 6.283 = 360°$

$(-165° = -2.880 = -11\pi/12)$ $195° = 3.403 = 13\tau/12$

$23\pi/12 = 6.021 = 345°$ $(-\pi/12 = -0.262 = -15°)$

$(-150° = -2.618 = -5\pi/6)$ $210° = 3.665 = 7\pi/6$

$11\pi/6 = 5.760 = 330°$ $(-\pi/6 = -0.524 = -30°)$

$(-135° = -2.356 = -3\pi/4)$ $225° = 3.927 = 5\pi/4$

$7\pi/4 = 5.498 = 315°$ $(-\pi/4 = -0.785 = -45°)$

$(-120° = -2.094 = -2\pi/3)$ $240° = 4.189 = 4\pi/3$

$5\pi/3 = 5.236 = 300°$ $(-\pi/3 = -1.047 = -60°)$

$(-105° = -1.833 = -7\pi/12)$ $255° = 4.451 = 17\pi/12$

$19\pi/12 = 4.974 = 285°$ $(-5\pi/12 = -1.309 = -75°)$

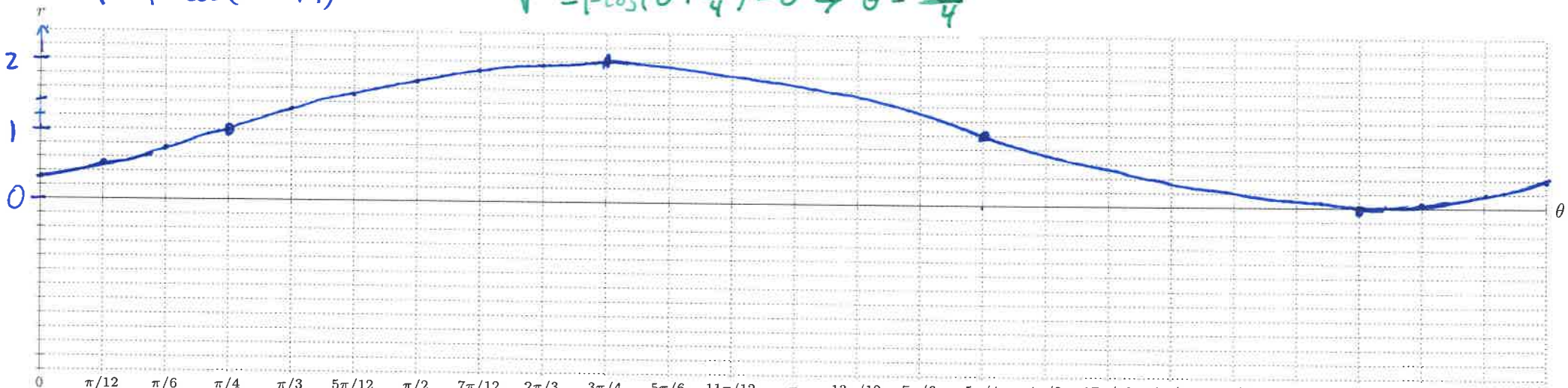
$4.712 = 3\pi/2 = 270°$

$(-1.571 = -\pi/2 = -90°)$

8.5.13

$r = 1 - \cos(\theta + \pi/4)$

$r = 1 - \cos(\theta + \frac{\pi}{4}) = 0 \Rightarrow \theta = \frac{7\pi}{4}$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
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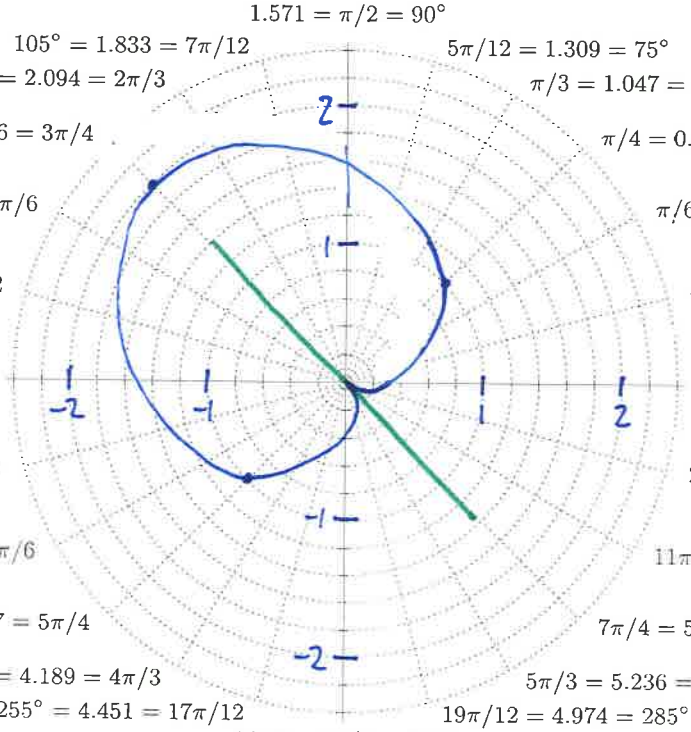
0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	360°
												$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
												−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
												−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°

Kalkulator:
Lager tabell med
steglengde $\frac{\pi}{12} = 0.261799$

$\cos(\theta + \frac{\pi}{4}) = 1$ når $\theta = -\frac{\pi}{4}$



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$165° = 2.880 = 11\tau/12$ $\pi/12 = 0.262 = 15°$

$(-180° = -3.142 = -\pi)$ $180° = 3.142 = \pi$ $0 = 0°$ $2\pi = 6.283 = 360°$

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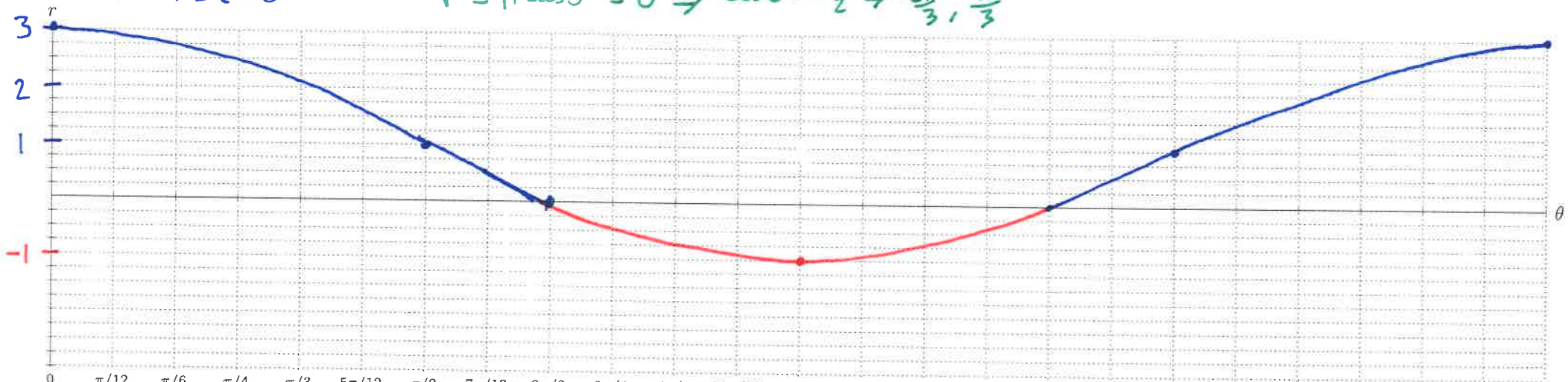
$4.712 = 3\pi/2 = 270°$

$(-1.571 = -\pi/2 = -90°)$

8.5.14

$r = 1 + 2\cos\theta$ $\quad r = 1 + 2\cos\theta = 0 \Rightarrow \cos\theta = -\frac{1}{2} \Rightarrow \frac{2\pi}{3}, \frac{4\pi}{3}$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
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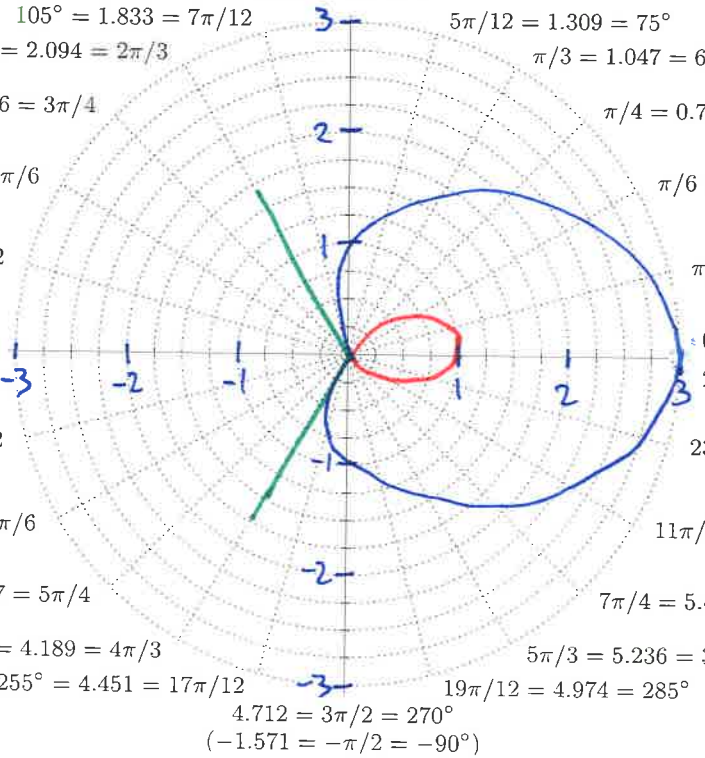
$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°



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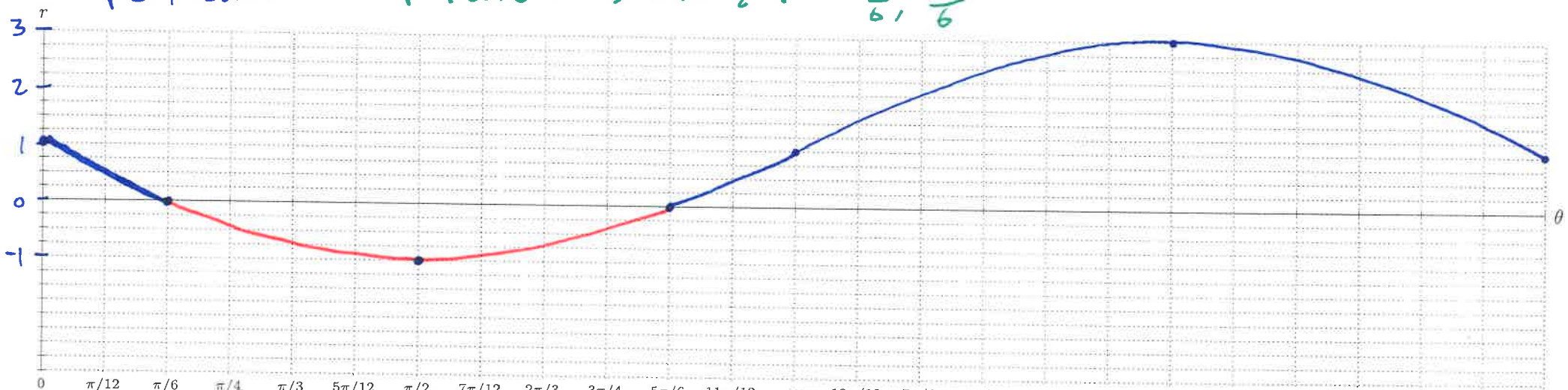
$4.712 = 3\pi/2 = 270°$

$(-1.571 = -\pi/2 = -90°)$

8.5.15

$r = 1 - 2\sin\theta$ $\quad r = 1 - 2\sin\theta = 0 \Rightarrow \sin\theta = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{6}, \frac{5\pi}{6}$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
0.000	0.262	0.524	0.785	1.047	1.309	1.571	1.833	2.094	2.356	2.618	2.880	3.142	3.403	3.665	3.927	4.189	4.451	4.712	4.974	5.236	5.498	5.760	6.021	6.283
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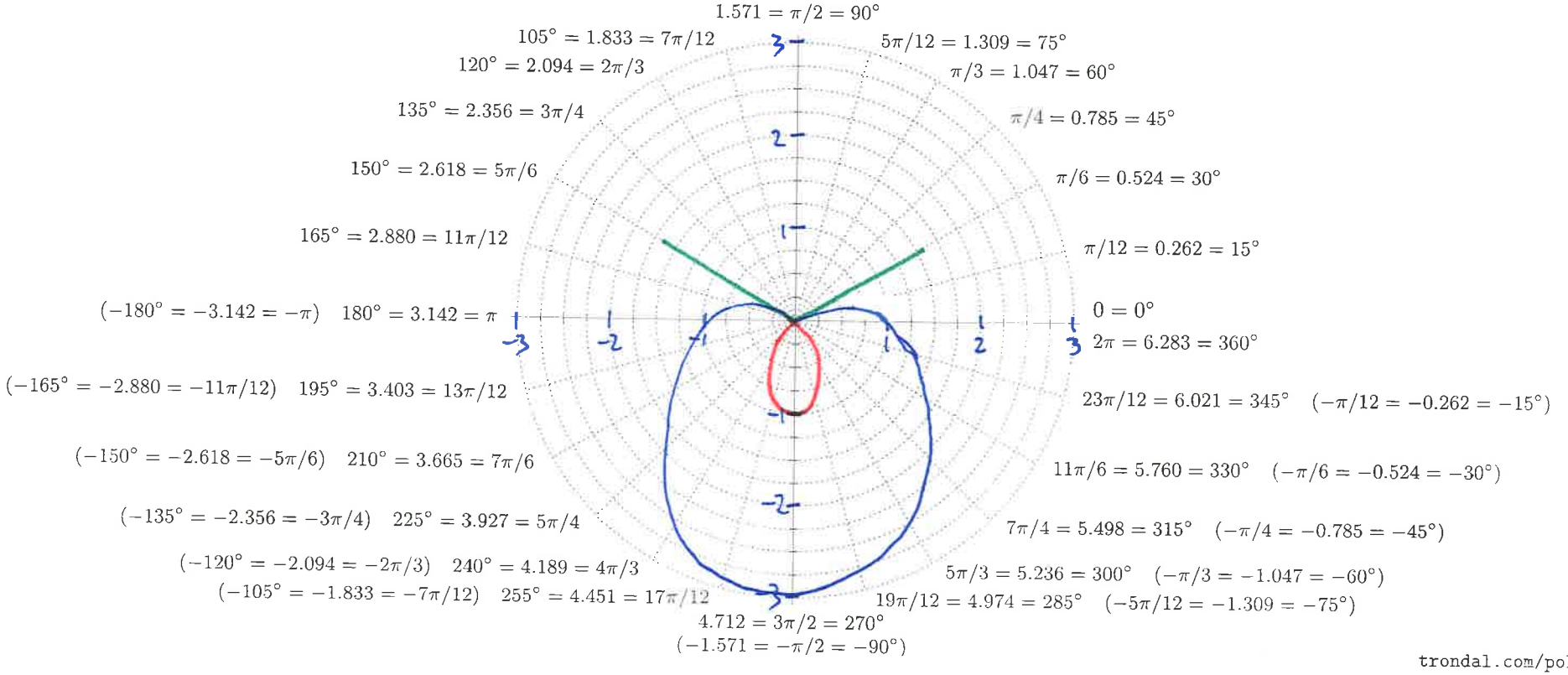
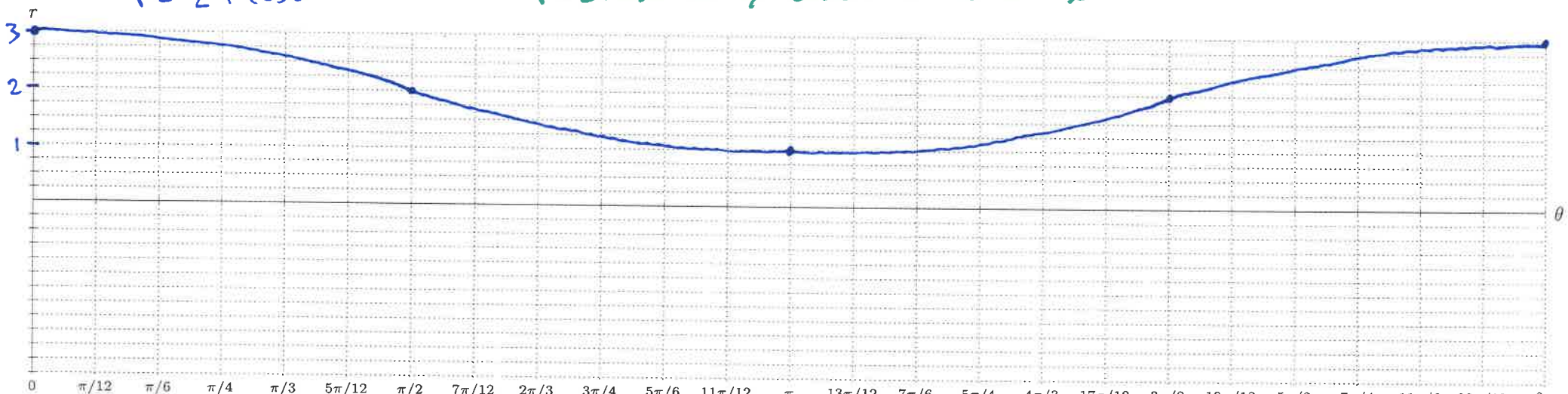
												$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
												−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
												−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°



8.5.16

$r = 2 + \cos\theta$

$r = 2 + \cos\theta = 0 \Rightarrow \cos\theta = -2 \Rightarrow \theta = \emptyset$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
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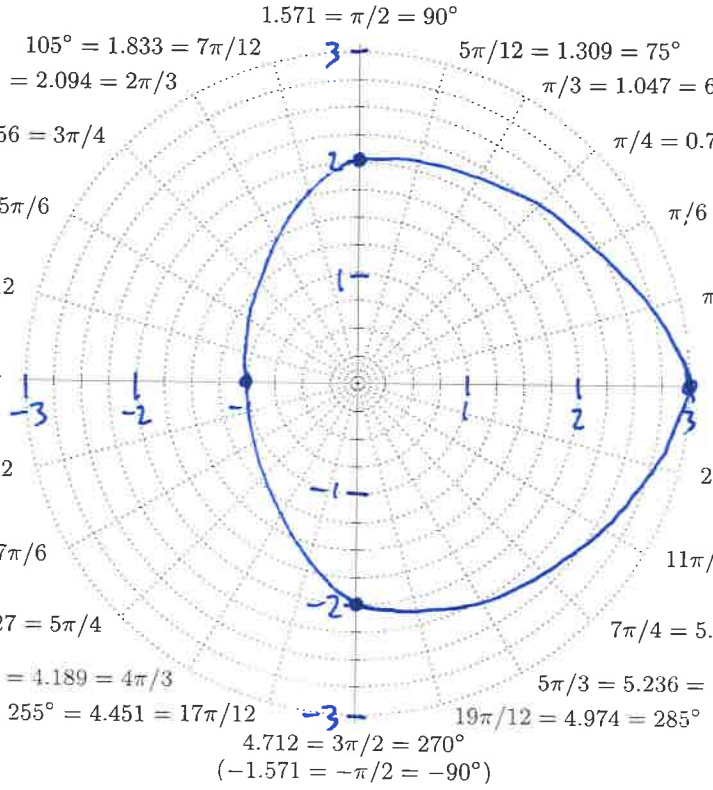
												$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
												-3.142	-2.880	-2.618	-2.356	-2.094	-1.833	-1.571	-1.309	-1.047	-0.785	-0.524	-0.262	0
												$-180°$	$-165°$	$-150°$	$-135°$	$-120°$	$-105°$	$-90°$	$-75°$	$-60°$	$-45°$	$-30°$	$-15°$	0°



$1.571 = \pi/2 = 90°$

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$165° = 2.880 = 11\pi/12$

$\pi/12 = 0.262 = 15°$

$(-180° = -3.142 = -\pi)$ $180° = 3.142 = \pi$

$0 = 0°$

$2\pi = 6.283 = 360°$

$(-165° = -2.880 = -11\pi/12)$ $195° = 3.403 = 13\pi/12$

$23\pi/12 = 6.021 = 345°$ $(-\pi/12 = -0.262 = -15°)$

$(-150° = -2.618 = -5\pi/6)$ $210° = 3.665 = 7\pi/6$

$11\pi/6 = 5.760 = 330°$ $(-\pi/6 = -0.524 = -30°)$

$(-135° = -2.356 = -3\pi/4)$ $225° = 3.927 = 5\pi/4$

$7\pi/4 = 5.498 = 315°$ $(-\pi/4 = -0.785 = -45°)$

$(-120° = -2.094 = -2\pi/3)$ $240° = 4.189 = 4\pi/3$

$5\pi/3 = 5.236 = 300°$ $(-\pi/3 = -1.047 = -60°)$

$(-105° = -1.833 = -7\pi/12)$ $255° = 4.451 = 17\pi/12$

$19\pi/12 = 4.974 = 285°$ $(-5\pi/12 = -1.309 = -75°)$

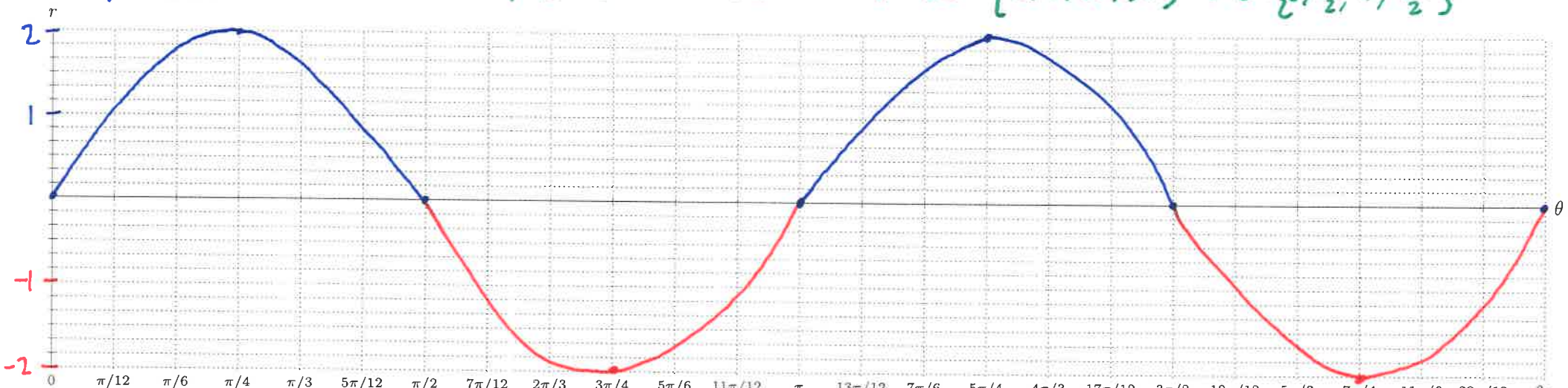
$4.712 = 3\pi/2 = 270°$

$(-1.571 = -\pi/2 = -90°)$

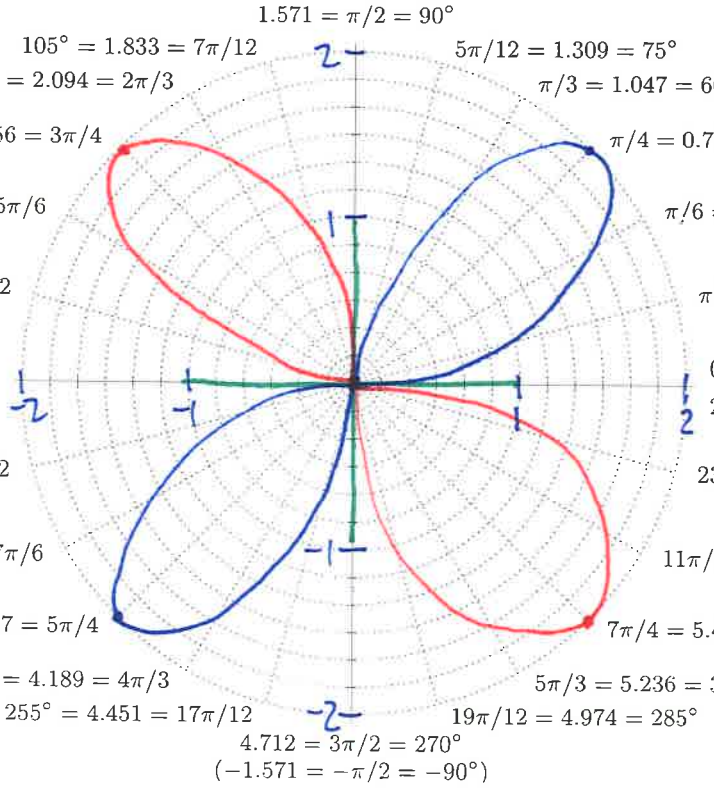
8.5.17

$r = 2\sin 2\theta$

$r = 2\sin 2\theta = 0 \Rightarrow \sin 2\theta = 0 \Rightarrow 2\theta = \{0, \pi, 2\pi, 3\pi\} \Rightarrow \theta = \{0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}\}$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
0.000	0.262	0.524	0.785	1.047	1.309	1.571	1.833	2.094	2.356	2.618	2.880	3.142	3.403	3.665	3.927	4.189	4.451	4.712	4.974	5.236	5.498	5.760	6.021	6.283
0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	360°
												$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
												−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
												−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°



$1.571 = \pi/2 = 90°$

$105° = 1.833 = 7\pi/12$ $\quad 5\pi/12 = 1.309 = 75°$

$120° = 2.094 = 2\pi/3$ $\quad \pi/3 = 1.047 = 60°$

$135° = 2.356 = 3\pi/4$ $\quad \pi/4 = 0.785 = 45°$

$150° = 2.618 = 5\pi/6$ $\quad \pi/6 = 0.524 = 30°$

$165° = 2.880 = 11\pi/12$ $\quad \pi/12 = 0.262 = 15°$

$(-180° = -3.142 = -\pi) \quad 180° = 3.142 = \pi$ $\quad 0 = 0°$

$2\pi = 6.283 = 360°$

$(-165° = -2.880 = -11\pi/12) \quad 195° = 3.403 = 13\pi/12$ $\quad 23\pi/12 = 6.021 = 345° \quad (-\pi/12 = -0.262 = -15°)$

$(-150° = -2.618 = -5\pi/6) \quad 210° = 3.665 = 7\pi/6$ $\quad 11\pi/6 = 5.760 = 330° \quad (-\pi/6 = -0.524 = -30°)$

$(-135° = -2.356 = -3\pi/4) \quad 225° = 3.927 = 5\pi/4$ $\quad 7\pi/4 = 5.498 = 315° \quad (-\pi/4 = -0.785 = -45°)$

$(-120° = -2.094 = -2\pi/3) \quad 240° = 4.189 = 4\pi/3$ $\quad 5\pi/3 = 5.236 = 300° \quad (-\pi/3 = -1.047 = -60°)$

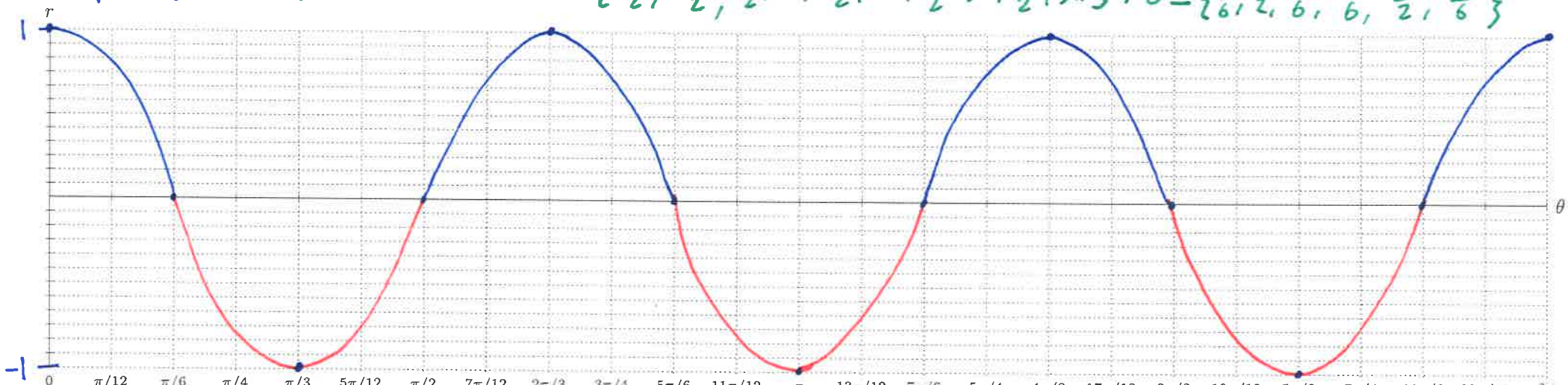
$(-105° = -1.833 = -7\pi/12) \quad 255° = 4.451 = 17\pi/12$ $\quad 19\pi/12 = 4.974 = 285° \quad (-5\pi/12 = -1.309 = -75°)$

$4.712 = 3\pi/2 = 270°$

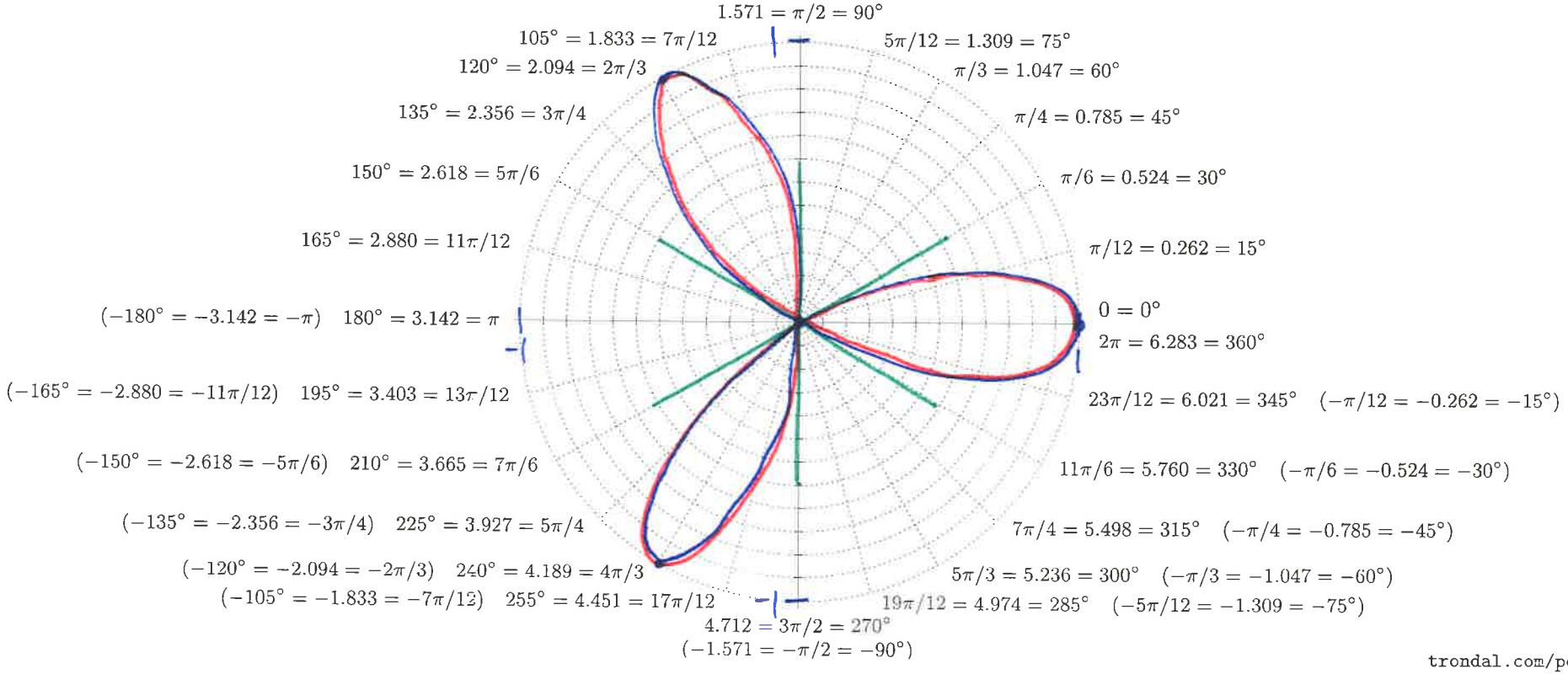
$(-1.571 = -\pi/2 = -90°)$

8.5.18

$r = \cos 3\theta$ $\quad r = \cos 3\theta = 0 \Rightarrow 3\theta = \left\{\frac{\pi}{2}, \frac{3\pi}{2}, \frac{\pi}{2}+2\pi, \frac{3\pi}{2}+2\pi, \frac{\pi}{2}+3\pi, \frac{3\pi}{2}+3\pi\right\} \Rightarrow \theta = \left\{\frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}\right\}$

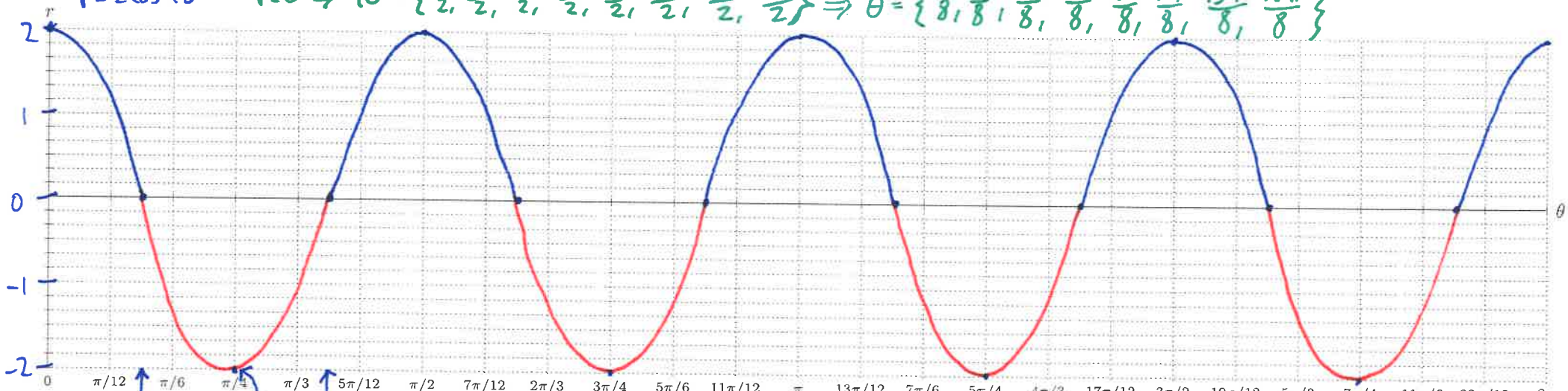


0	π/12	π/6	π/4	π/3	5π/12	π/2	7π/12	2π/3	3π/4	5π/6	11π/12	π	13π/12	7π/6	5π/4	4π/3	17π/12	3π/2	19π/12	5π/3	7π/4	11π/6	23π/12	2π
0.000	0.262	0.524	0.785	1.047	1.309	1.571	1.833	2.094	2.356	2.618	2.880	3.142	3.403	3.665	3.927	4.189	4.451	4.712	4.974	5.236	5.498	5.760	6.021	6.283
0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	360°
												−π	−11π/12	−5π/6	−3π/4	−2π/3	−7π/12	−π/2	−5π/12	−π/3	−π/4	−π/6	−π/12	0
												−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
												−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°



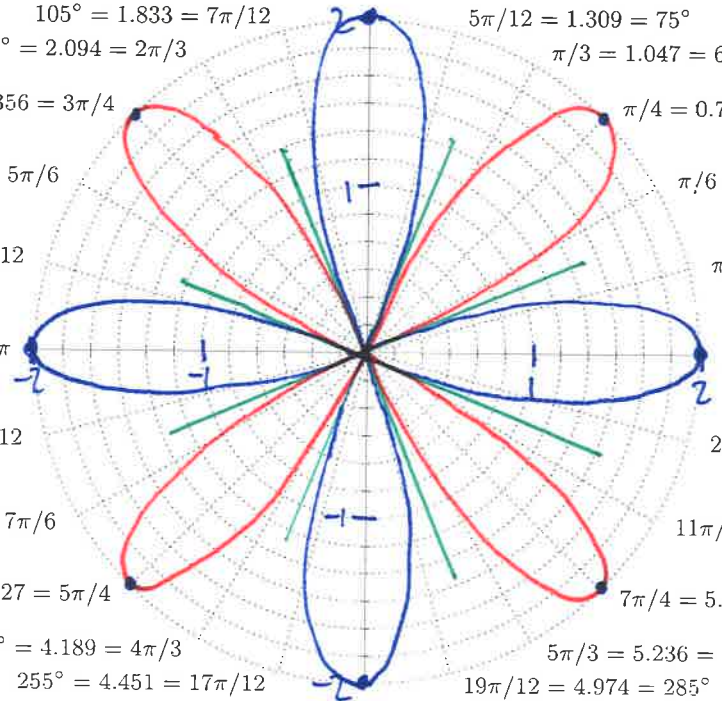
8.5.19

$r = 2\cos 4\theta$ $\quad r=0 \Rightarrow 4\theta = \left\{\frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2}, \frac{9\pi}{2}, \frac{11\pi}{2}, \frac{13\pi}{2}, \frac{15\pi}{2}\right\} \Rightarrow \theta = \left\{\frac{\pi}{8}, \frac{3\pi}{8}, \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8}, \frac{11\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}\right\}$



0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$5\pi/12$	$\pi/2$	$7\pi/12$	$2\pi/3$	$3\pi/4$	$5\pi/6$	$11\pi/12$	π	$13\pi/12$	$7\pi/6$	$5\pi/4$	$4\pi/3$	$17\pi/12$	$3\pi/2$	$19\pi/12$	$5\pi/3$	$7\pi/4$	$11\pi/6$	$23\pi/12$	2π
0.000	0.262	0.524	0.785	1.047	1.309	1.571	1.833	2.094	2.356	2.618	2.880	3.142	3.403	3.665	3.927	4.189	4.451	4.712	4.974	5.236	5.498	5.760	6.021	6.283
0°	15°	30°	45°	60°	75°	90°	105°	120°	135°	150°	165°	180°	195°	210°	225°	240°	255°	270°	285°	300°	315°	330°	345°	360°
												$-\pi$	$-11\pi/12$	$-5\pi/6$	$-3\pi/4$	$-2\pi/3$	$-7\pi/12$	$-\pi/2$	$-5\pi/12$	$-\pi/3$	$-\pi/4$	$-\pi/6$	$-\pi/12$	0
												−3.142	−2.880	−2.618	−2.356	−2.094	−1.833	−1.571	−1.309	−1.047	−0.785	−0.524	−0.262	0
												−180°	−165°	−150°	−135°	−120°	−105°	−90°	−75°	−60°	−45°	−30°	−15°	0°

$\frac{1}{2}\cdot\frac{\pi}{4} = \frac{\pi}{8}$ $\qquad \frac{\pi}{4}$ $\qquad \frac{1}{2}\left(\frac{\pi}{3} + \frac{5\pi}{12}\right) = \frac{3\pi}{8}$



$1.571 = \pi/2 = 90°$
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8.5.20