Department of Mathematics and Statistics

Differential Calculus

Lab Assignment 1

NOTE: For this lab assignment calculators are NOT permitted

Show ALL your work to receive FULL credit.

1. Identify the type of curve and sketch the graph.

    (a) (3 marks) $7y^2 - 4x^2 = 28$

    (b) (5 marks) $x^2 + 2x + y^2 = 15$

    (c) (5 marks) $x = -2y^2 + 4y + 3$

2. (5 marks) Find an equation of the tangent line to the circle $x^2 + y^2 = 100$ which is parallel to $4x + 3y = 2$.

3. (3 marks) Convert from radians to degrees (show your work): $\frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \frac{7\pi}{4}, \frac{10\pi}{3}$

4. (2 marks) Convert from degrees to radians (show your work): $30°, 120°, 135°, -315°$.

5. (12 marks) Find the exact values of all six trigonometric ratios for the angle whose radian measure is $\frac{13\pi}{4}, \frac{11\pi}{2}, \frac{11\pi}{3}, \frac{53\pi}{6}$. (show your work)

1a)

(0,2)
(0,-2)

$\frac{2}{3}$

-1
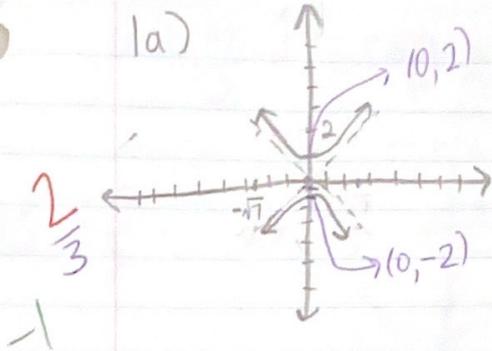
hyperbola

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

$\frac{7y^2}{28} - \frac{4x^2}{28} = 1$ ✓

$\frac{y^2}{4} - \frac{x^2}{7} = 1$ $\sqrt{7}$

1b) $x^2 + 2x + y^2 = 15$ ✓
$(x^2 + 2x + 1) + y^2 = 15 + 1$ ✓
$(x+1)^2 + (y+0)^2 = 16$

$\frac{5}{5}$

center at $(-1, 0)$
radius of 4 ✓

1c) $x = -2y^2 + 4y + 3$

$\frac{5}{5}$
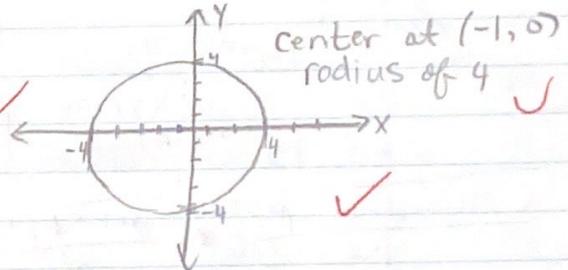
opens left because a value
is negative ✓
axis of symmetry → $\frac{-b}{2a} = \frac{-4}{(-2)(2)} = 1$

$x = -2(1)^2 + 4(1) + 3 =$ ✓
$= -2(1) + 4 + 3$
$= -2 + 7$
$= 5$ ✓
$(5, 1)$ → vertex

2)

-15

$\frac{2.5}{4}$

point (0,6)
tan line eqn = ?
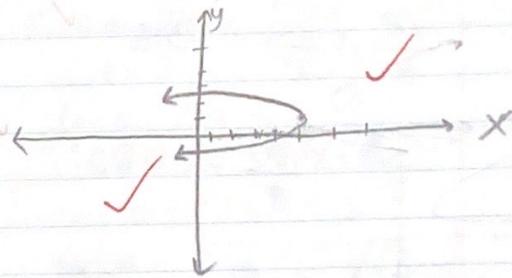
parallel to $4x + 3y = 2$
$3y = 2 - 4x$
$y = \frac{2}{3} - \frac{4x}{3}$

slope $= -4/3$ because
it is parallel

$x^2 + y^2 = 100$

(a,b) point on tangent line
Tan line slope $= -4/3$ ✓

$y - y_0 = m(x - x_0)$
$x^2 + y^2 = 100$

$(4/3y)^2 + y^2 = 100$
$16/9 y^2 + y^2 = 100$
$y = \pm 6$

→ Sub in 6 for y, $x = 8$
$y - 6 = -4/3(x - 8)$ ✓

3) radians → degrees is multiply by $\frac{180}{\pi}$

3/3

$\frac{\pi}{6} \times \frac{180}{\pi} = 30°$ ✓

$\frac{\pi}{4} \times \frac{180}{\pi} = 45°$ ✓

$\frac{\pi}{3} \times \frac{180}{\pi} = 60°$ ✓

$\frac{\pi}{2} \times \frac{180}{\pi} = 90°$ ✓

$\frac{7\pi}{4} \times \frac{180}{\pi} = 315°$ ✓

$\frac{10\pi}{3} \times \frac{180}{\pi} = 600°$ ✓

2/2

4) $30° \times \pi/180 = \frac{30\pi}{180} = \frac{3\pi}{18} = \frac{\pi}{6}$ ✓

$120° \times \pi/180 = \frac{120\pi}{180} = 2\pi/3$ ✓

$135° \times \pi/180 = \frac{135\pi}{180} = \frac{27\pi}{36} = \frac{3\pi}{4}$ ✓

$-315° \times \pi/180 = \frac{-315\pi}{180} = \frac{-63\pi}{36} = \frac{-21\pi}{12} = \frac{-7\pi}{4}$ ✓

5) a) $\frac{13\pi}{4}$

$= \left(2\pi + \frac{5\pi}{4}\right)$

3/3
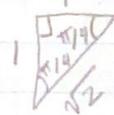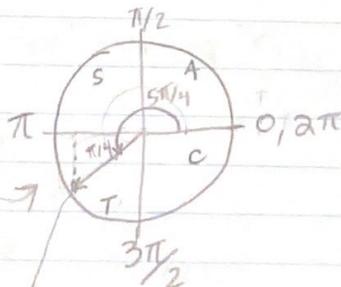
$\sin\theta = \frac{y}{r} = -1/\sqrt{2}$ ✓

$\cos\theta = \frac{x}{r} = -1/\sqrt{2}$ ✓

$\tan\theta = \frac{y}{x} = 1$ ✓

$\csc\theta = r/y = -\sqrt{2}$ ✓

$\sec\theta = r/x = -\sqrt{2}$ ✓

$\cot\theta = \frac{x}{y} = 1$ ✓

5b) $\dfrac{11\pi}{2} = \left(4\pi + 3\pi/2\right)$

-0.5 $\dfrac{2.5}{3}$
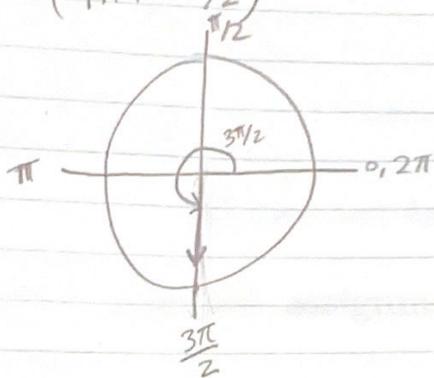
$\sin\theta = y/r = -1$ ✓
$\cos\theta = x/r = 0$ ✓
$\tan\theta = y/x = $ undefined ✓
$\csc\theta = r/y = -1$ ✓
$\sec\theta = r/x = 0$ und
$\cot\theta = x/y = 0$ ✓

5c) $\dfrac{11\pi}{3} = \left(3\pi + \dfrac{2\pi}{3}\right)$

-2 $\dfrac{1}{3}$

$2 = r$ $\sqrt{3} = y$ $1 = x$ $\pi/3$
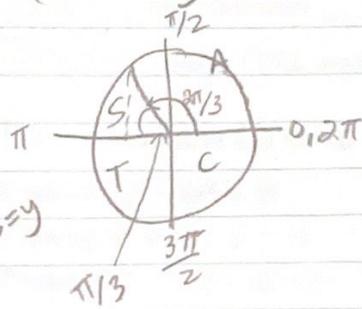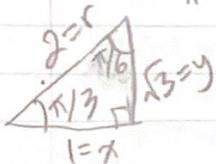
$\sin\theta = y/r = \sqrt{3}/2$
$\cos\theta = x/r = +1/2$
$\tan\theta = y/x = -\sqrt{3}$ ✓
$\csc\theta = r/y = -2/\sqrt{3}$
$\sec\theta = r/x = \pm 2$
$\cot\theta = x/y = -1/\sqrt{3}$ ✓

5d) $\dfrac{53\pi}{6} = \left(8\pi + 5\pi/6\right)$

$\dfrac{3}{3}$

$2 = r$ $\sqrt{3} = y$ $1 = x$
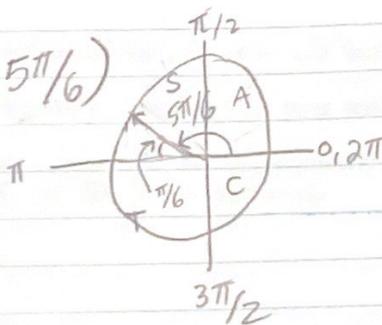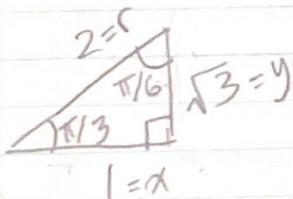
$\sin\theta = y/r = 1/2$ ✓
$\cos\theta = x/r = -\sqrt{3}/2$ ✓
$\tan\theta = y/x = -1/\sqrt{3}$
$\csc\theta = r/y = 2$ ✓
$\sec\theta = r/x = -2/\sqrt{3}$ ✓
$\cot\theta = x/y = -\sqrt{3}$ ✓