

Answer all questions below. All questions are worth 1 point except where otherwise noted. No cell phones, calculators, or notes are allowed during the exam. If you are stuck on a problem, skip it and come back to it later. The exam will last 120 minutes.

Name: _____ UID: _____

Write all your answers in the answer booklet provided.

True or False

Decide whether each statement is true or false. Worth $\frac{1}{2}$ point each.

1. The point $(\frac{\sqrt{3}}{2}, -\frac{1}{2})$ lies on the unit circle.
2. If S is the set of solutions to the equation $x^3 + y^3 = xy$, then $(-1, 1) \in S$.
3. The planar transformation $A_{(2,3)}$ shifts up by 3 and right by 2.
4. The matrix $\begin{pmatrix} \frac{\sqrt{3}}{2} & \frac{1}{2} \\ -\frac{1}{2} & \frac{\sqrt{3}}{2} \end{pmatrix}$ rotates the plane clockwise by an angle of $\frac{\pi}{4}$.
5. If θ is any real number, then $\cos(-\theta) = \cos(\theta)$.
6. If θ is any real number, then $\sin(-\theta) = \sin(\theta)$.
7. The equation $x^2 e^x = (x + 1)e^x$, with domain \mathbb{R} is equivalent to the equation $x^2 = x + 1$.
8. The equation $\log_{10}(x)^2 = 4$, with domain $(0, \infty)$, is equivalent to the equation $\log_{10}(x) = 2$.

Linear Algebra

9. Write the resulting vector as a row vector:

$$\begin{pmatrix} 3 & -4 \\ 1 & 2 \end{pmatrix} \begin{pmatrix} -1 \\ 5 \end{pmatrix} =$$

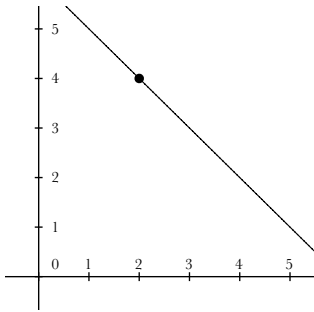
10. Find the product:

$$\begin{pmatrix} 3 & 0 \\ -2 & -1 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ 1 & -4 \end{pmatrix}$$

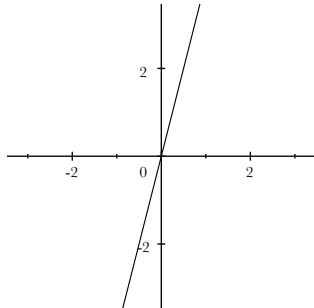
11. Find the norm of the vector $(1, 7)$.

Conics and Solutions of Equations in Two Variables

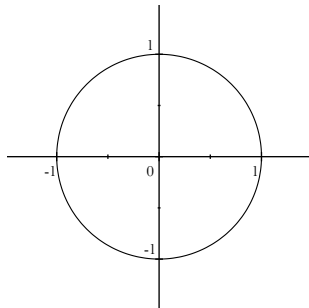
12. Give the equation for a line of slope -1 , through the point $(2, 4)$



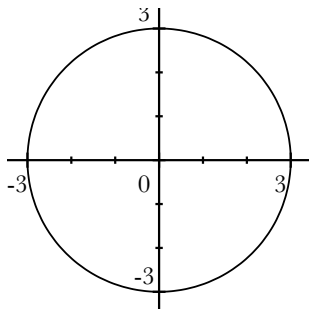
13. Give the equation for the line of slope 4 through the origin.



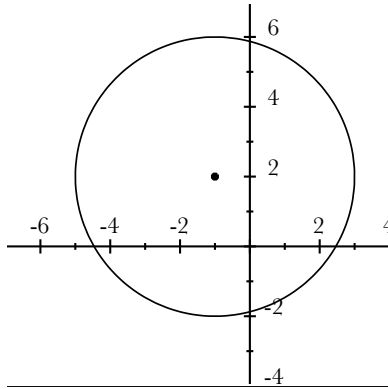
14. Give the equation for the unit circle.



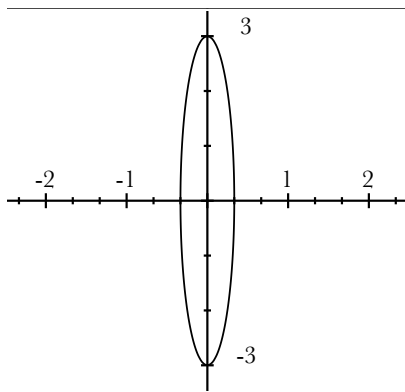
15. Give the equation for the circle of radius 3 centered at the origin.



16. (2 points) Give the equation for the circle of radius 4 centered at the point $(-1, 2)$.



17. (2 points) Give the equation for the ellipse obtained by starting with the unit circle, then scaling the x -axis by $\frac{1}{3}$ and the y -axis by 3.

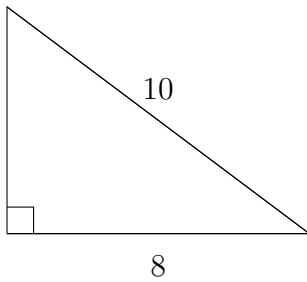


18. Draw the set of solutions to the equation $xy = 1$.
19. Draw the set of solutions to the equation $y = x^2$.
20. Draw the set of solutions to the equation $x^2 + y^2 = 9$.
21. Draw the set of solutions to the equation $\frac{x^2}{9} + \frac{y^2}{4} = 1$
22. Draw the set of solutions to the equation $(x - y)(x + y) = 0$.
23. Draw the set of solutions to the equation $(x + 2)^2 + (y - 1)^2 = 0$.
24. Let H be the set of solutions to $xy = 1$ (from #18). $R_{-\frac{\pi}{4}}$ is the rotation of the plane by angle $-\frac{\pi}{4}$. Draw $R_{-\frac{\pi}{4}}(H)$.
25. Let P be the set of solutions to $y = x^2$ (from #19). Draw P shifted left by 2 and up by 2.

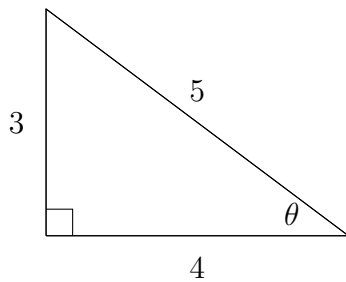
Trigonometry

26. What is the distance from the point $(3, 3)$ to the point $(-1, 2)$?

27. Find the length of the unlabeled side of the triangle below.



28. (3 points) Find $\sin(\theta)$, $\cos(\theta)$, $\tan(\theta)$ for the angle θ shown below.



29. If $\cos(\theta) = \frac{1}{4}$, and $\sin(\theta) > 0$, what is $\sin(\theta)$?

30. Find $\sec(-\frac{\pi}{3})$.

31. Find $\csc(\frac{\pi}{4})$.

32. Find $\tan(\frac{\pi}{3})$.

33. Find $\arccos(\frac{\sqrt{3}}{2})$.

34. Find $\arcsin(\frac{1}{2})$.

35. Find $\arctan(-1)$.

For #36-44, graph the functions listed below.

36. $\cos(x)$

39. $\sec(x)$

42. $\arccos(x)$

37. $\sin(x)$

40. $\csc(x)$

43. $\arcsin(x)$

38. $\tan(x)$

41. $\cot(x)$

44. $\arctan(x)$

Match the functions with their graphs.

45. $\cos(x)$

49. $2 \cos(x)$

53. $\cos(x) + 1$

46. $\sin(x)$

50. $\cos(2x)$

54. $\cos(x) - 1$

47. $\cos(\frac{x}{2})$

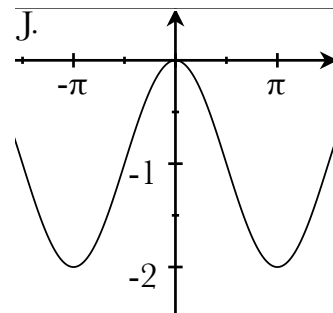
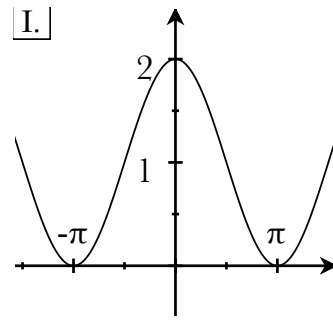
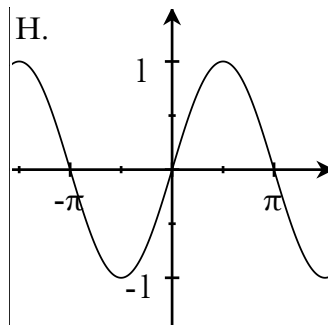
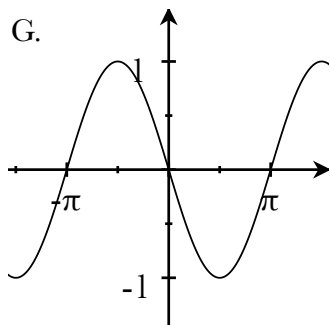
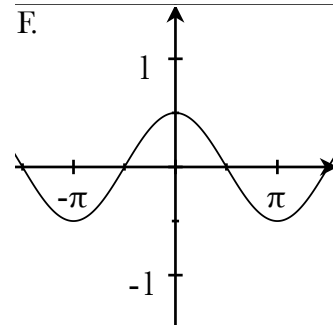
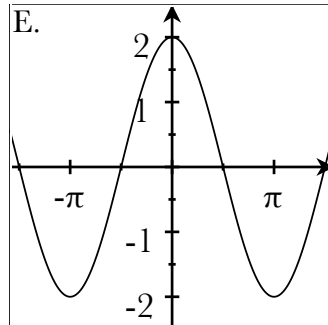
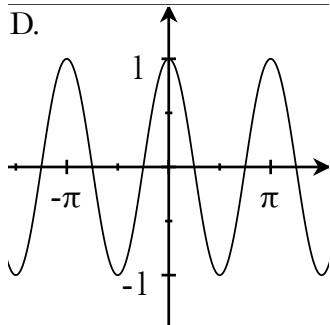
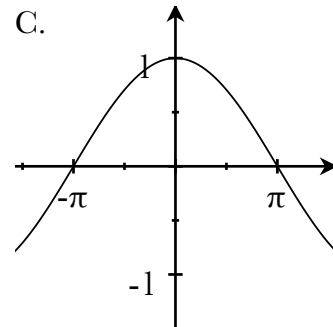
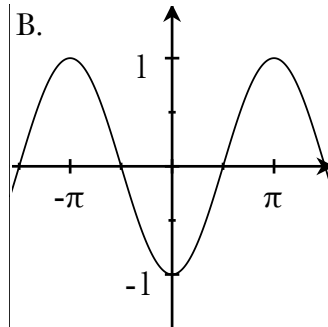
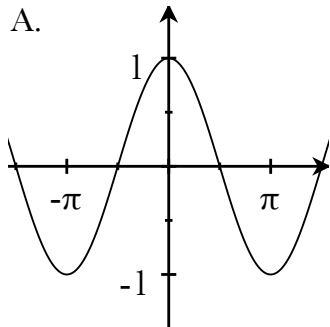
51. $\cos(x + \frac{\pi}{2})$

55. $-\cos(x)$

48. $\frac{1}{2} \cos(x)$

52. $\cos(x - \frac{\pi}{2})$

56. $\cos(-x)$



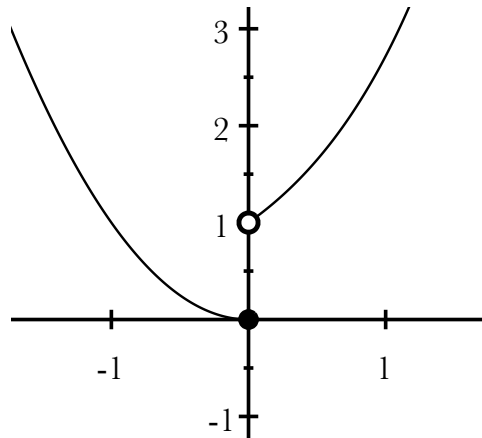
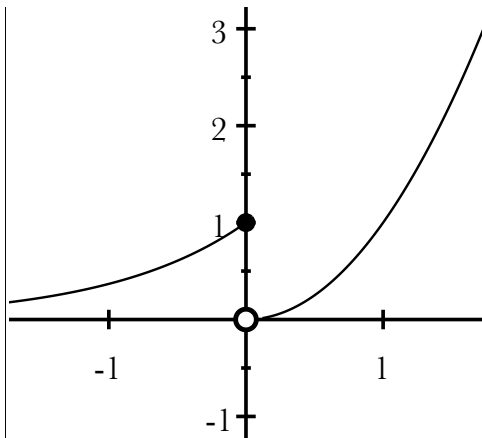
Match the functions with their graphs.

$$57. f(x) = \begin{cases} e^x & \text{if } x \leq 0 \\ x^2 & \text{if } x > 0 \end{cases}$$

$$58. g(x) = \begin{cases} e^x & \text{if } x > 0 \\ x^2 & \text{if } x \leq 0 \end{cases}$$

A.

B.



59. (2 points) Write the matrix that rotates the plane counter clockwise by an angle of $\frac{\pi}{3}$.

60. If $\sin(\theta) = \frac{2}{3}$ and $\cos(\theta) = -\frac{\sqrt{5}}{3}$, find $\sin(2\theta)$. (Hint: $\sin(2\theta) = \sin(\theta + \theta)$.)

Equations in One Variable

Questions #61-66 can be found in your answer booklet.

Name: _____ UID: _____

1. _____

2. _____ 10. _____

3. _____ 11. _____

4. _____ 12. _____

5. _____ 13. _____

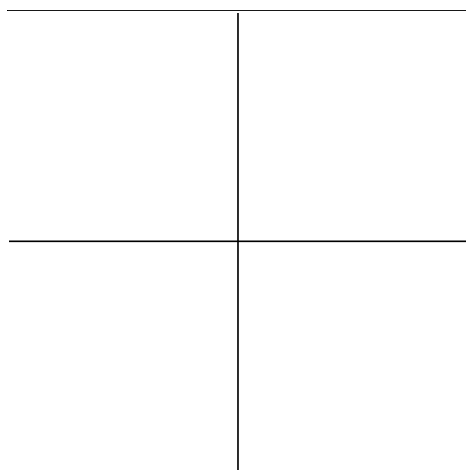
6. _____ 14. _____

7. _____ 15. _____

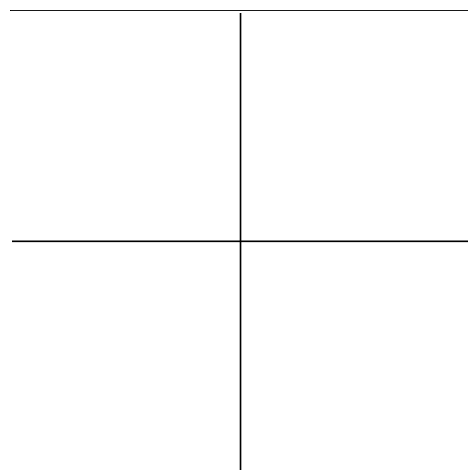
8. _____ 16. _____

9. _____ 17. _____

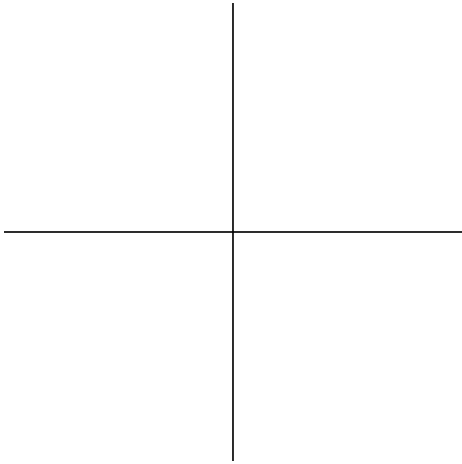
18.



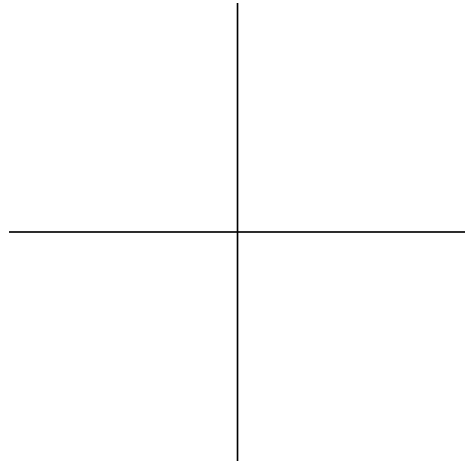
19.



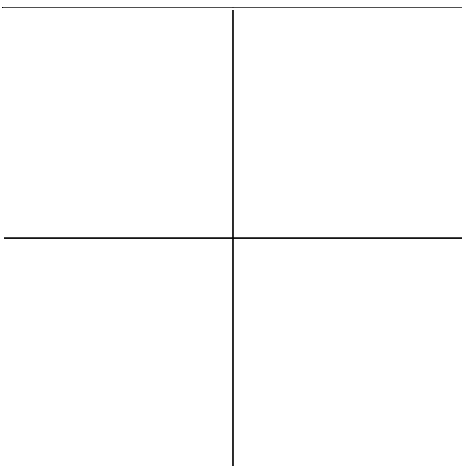
20.



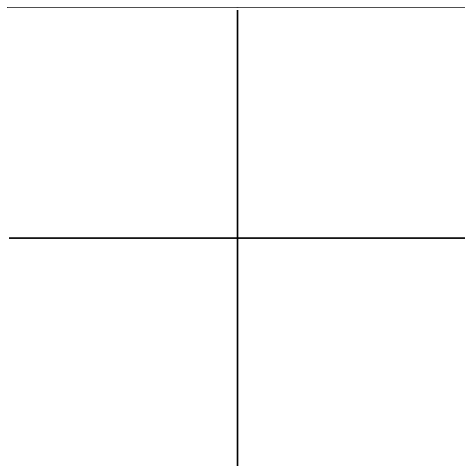
23.



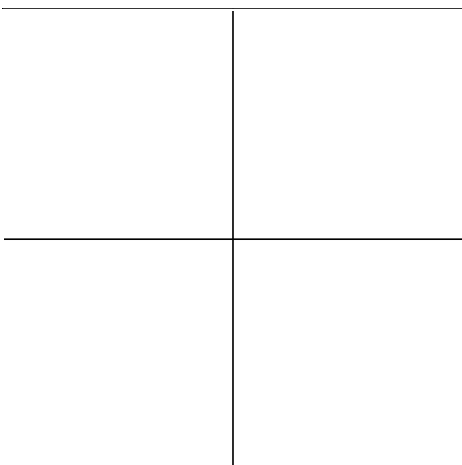
21.



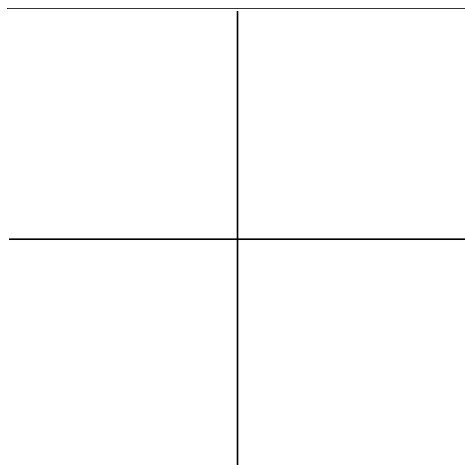
24.



22.



25.



26. _____ 31. _____

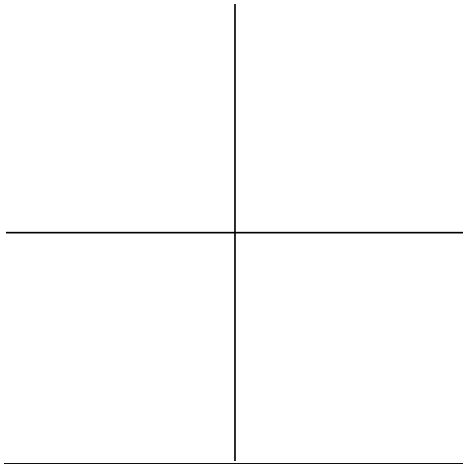
27. _____ 32. _____

28. _____ 33. _____

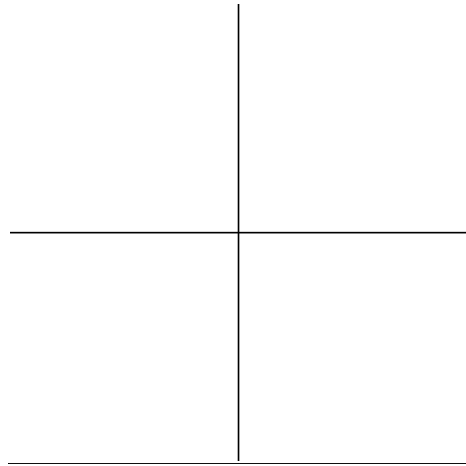
29. _____ 34. _____

30. _____ 35. _____

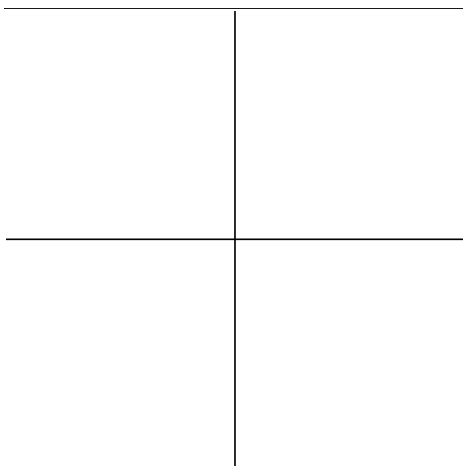
36. $\cos(x)$



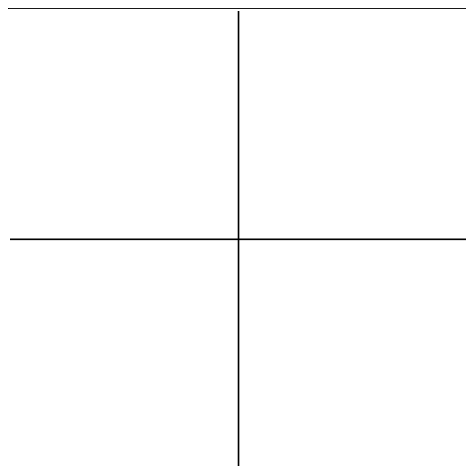
38. $\tan(x)$



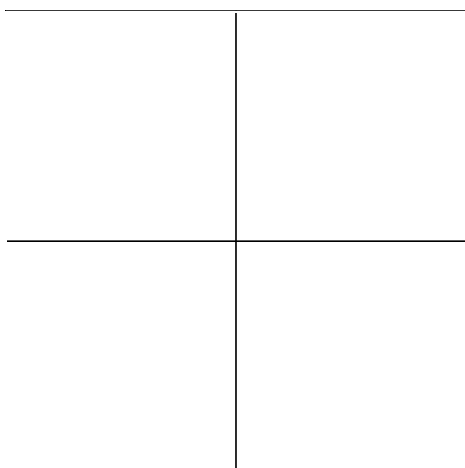
37. $\sin(x)$



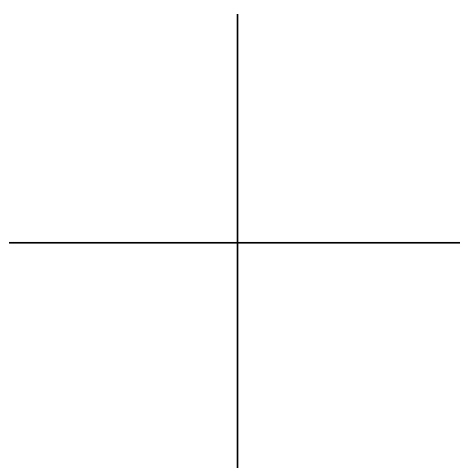
39. $\sec(x)$



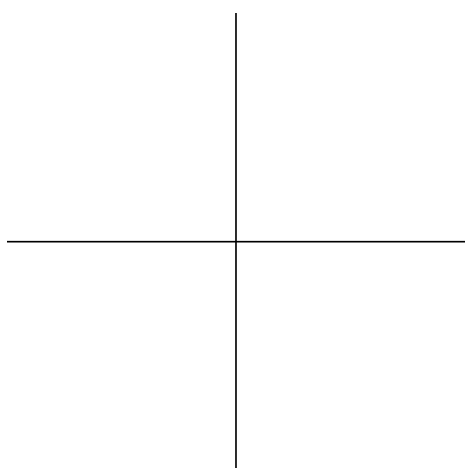
40. $\csc(x)$



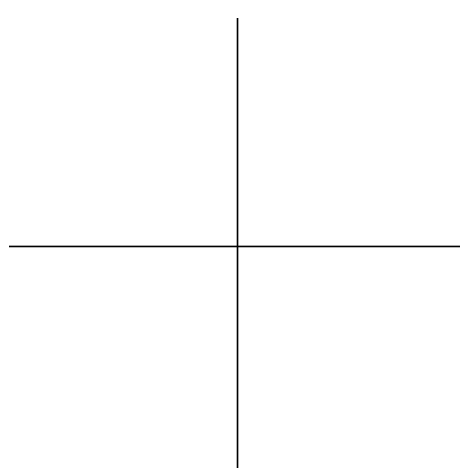
43. $\arcsin(x)$



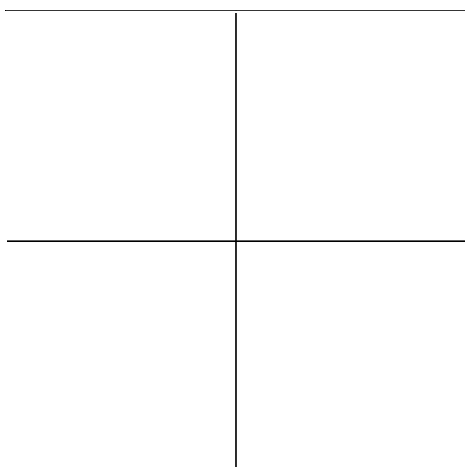
41. $\cot(x)$



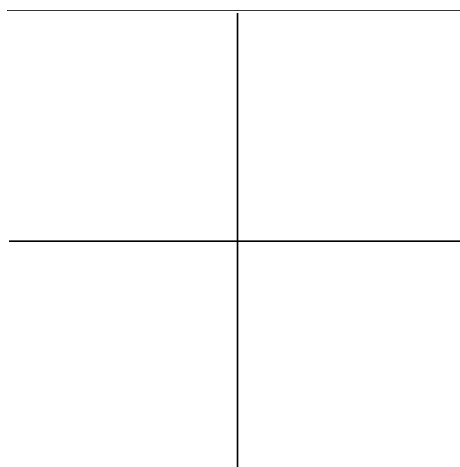
44. $\arctan(x)$



42. $\arccos(x)$



**.



45. _____ 53. _____

46. _____ 54. _____

47. _____ 55. _____

48. _____ 56. _____

49. _____ 57. _____

50. _____ 58. _____

51. _____ 59. _____

52. _____ 60. _____

Find all solutions to the following equations. If there are no solutions, write one sentence explaining why.

61. $\log_{10}(x - 2)e^x = 2\log_{10}(x - 2)$

62. $x^2 + 4 = 0$

$$63. \log_2(x + 2) = \log_2(x - 1) - \log_2(x + 1)$$

$$64. 2(e^x)^2 - 3e^x + 1 = 0$$

$$65. \log_3(1 - x) = 2 - \log_3(x - 4)$$

$$66. \log_e(x - 1)^2 = 9$$