

Dear AP Calculus Student,

Welcome to AP Calculus. This course is primarily concerned with developing your understanding of the concepts of calculus and providing experience with its methods and applications. The course emphasizes a multi-representational approach to calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. In order to be successful in this course you need the proper foundation. (i.e., knowledge of algebra, geometry, trigonometry, analytic geometry, and elementary functions). You will have to be very familiar with the basic families of functions, and all of their representations, in order to be successful in your study of calculus. The concept of functions underlies everything that calculus considers.

You will also need to be able to carry out certain computational tasks (i.e., algebra skills) with efficiency and accuracy if you are going to be successful in calculus. These include manipulations of functional symbolism, solving algebraic equations involving the functions mentioned above, interpreting numerical values given by formulas, graphs, and tables, using and manipulating data, and knowing how, and when to use your calculator.

This is a rigorous college course. The curriculum and pace of the course is intense and all enrolled students are required to take the AP exam. Since this is a *college class* you can expect to spend approximately 1-2 hours completing homework or studying for every hour that you are in class learning. Each test and quiz that is given is *cumulative* and will be graded as per the College Board guidelines. Therefore, this course will be challenging and demanding.

The following assignment is due on the **first day** of school. Moreover, **you will be tested on this material throughout the entire year.**

Feel free to contact me with any questions or concerns that you or your parents may have. Have a restful summer and be ready for an exciting time in AP Calculus next year.

Sincerely,

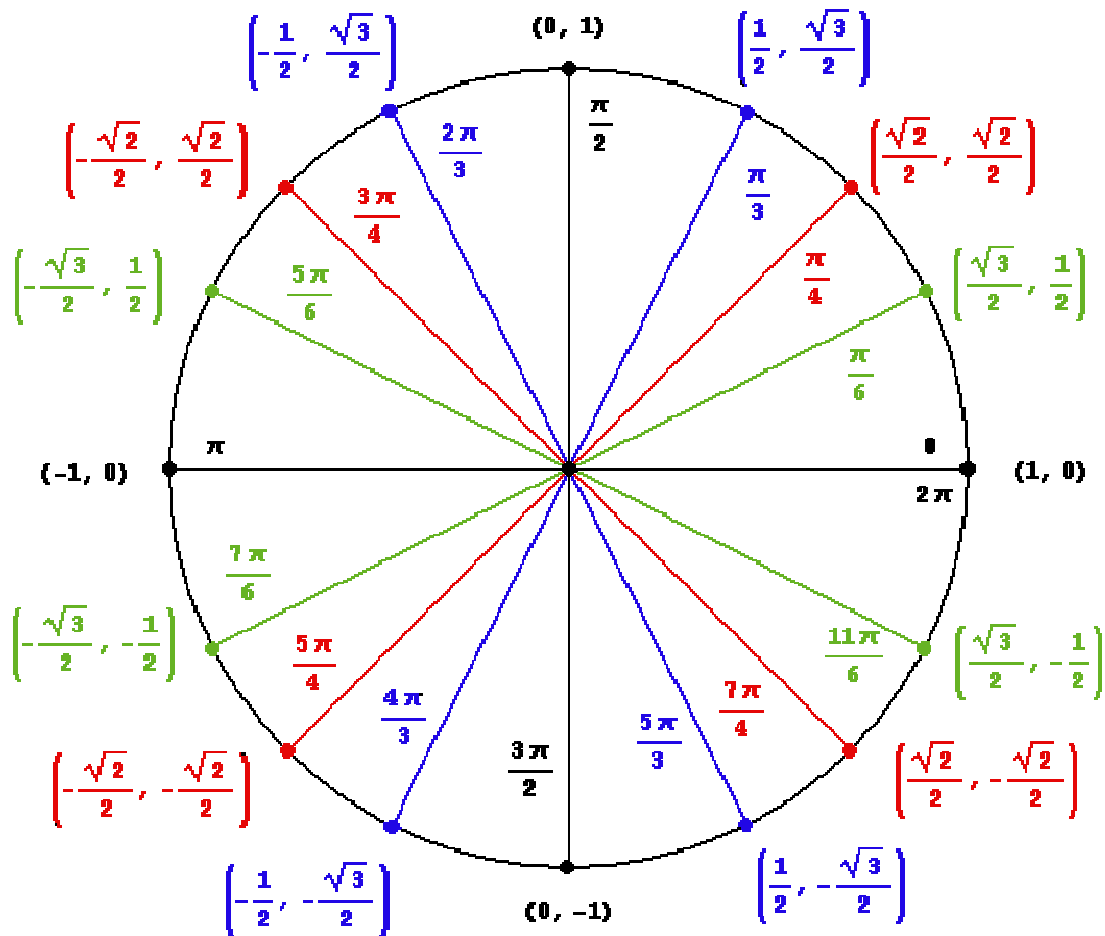
Isaac Bumgardner
Isaac.Bumgardner@fcps.edu

The following Trigonometric Identities **MUST** be **memorized**

Reciprocal Identities	Quotient Identities	Pythagorean Identities										
$\sin x = \frac{1}{\csc x} \quad \csc x = \frac{1}{\sin x}$ $\cos x = \frac{1}{\sec x} \quad \sec x = \frac{1}{\cos x}$ $\tan x = \frac{1}{\cot x} \quad \cot x = \frac{1}{\tan x}$	$\tan x = \frac{\sin x}{\cos x}$ $\cot x = \frac{\cos x}{\sin x}$	$\sin^2 x + \cos^2 x = 1$ $\tan^2 x + 1 = \sec^2 x$ $1 + \cot^2 x = \csc^2 x$										
Co-Function Identities	Odd/Even Identities											
$\sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta \quad \cos\left(\frac{\pi}{2} - \theta\right) = \sin \theta$ $\csc\left(\frac{\pi}{2} - \theta\right) = \sec \theta \quad \sec\left(\frac{\pi}{2} - \theta\right) = \csc \theta$ $\tan\left(\frac{\pi}{2} - \theta\right) = \cot \theta \quad \cot\left(\frac{\pi}{2} - \theta\right) = \tan \theta$	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; padding: 5px;"><u>Odd</u></td> <td style="text-align: center; padding: 5px;"><u>Even</u></td> </tr> <tr> <td style="padding: 5px;">$\sin(-\theta) = -\sin \theta$</td> <td style="padding: 5px;">$\cos(-\theta) = \cos \theta$</td> </tr> <tr> <td style="padding: 5px;">$\csc(-\theta) = -\csc \theta$</td> <td style="padding: 5px;">$\sec(-\theta) = \sec \theta$</td> </tr> <tr> <td style="padding: 5px;">$\tan(-\theta) = -\tan \theta$</td> <td></td> </tr> <tr> <td style="padding: 5px;">$\cot(-\theta) = -\cot \theta$</td> <td></td> </tr> </table>		<u>Odd</u>	<u>Even</u>	$\sin(-\theta) = -\sin \theta$	$\cos(-\theta) = \cos \theta$	$\csc(-\theta) = -\csc \theta$	$\sec(-\theta) = \sec \theta$	$\tan(-\theta) = -\tan \theta$		$\cot(-\theta) = -\cot \theta$	
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Double Angle Identities	Half Angle Identities											
$\sin 2x = 2 \sin x \cos x$ $\cos 2x = \cos^2 x - \sin^2 x$ $\cos 2x = 2 \cos^2 x - 1$ $\cos 2x = 1 - 2 \sin^2 x$	$\sin^2 x = \frac{1 - \cos 2x}{2}$ $\cos^2 x = \frac{1 + \cos 2x}{2}$											

The Radian Measures and Coordinates **MUST** be memorized

Remember: $\sin \theta = \frac{y}{r} = y\text{-coordinate}$, $\cos \theta = \frac{x}{r} = x\text{-coordinate}$, and $\tan \theta = \frac{y}{x} = \frac{y\text{-coordinate}}{x\text{-coordinate}}$



Name _____

These must be completed by the first day of school! Please show all work and box in your answer. Use the attached graph paper (or your own) for all of your sketches.

**The following questions are to be completed
without the use of a calculator**

I. Algebraic Manipulation

Factor the following:

1. $a^3 + b^3$

2. $4x^2 - 21x - 18$

3. $3x^2 + 6x^3 - 9x$

Simplify the expression

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

5. $\frac{\sqrt{x}}{\sqrt{x} + 3}$

6. $\frac{(9x^2 + 3x - 2)}{(9x^2 - 1)} \cdot \frac{(3x^2 + 13x + 4)}{(27x^3 + 8)}$

7. $\frac{x + \frac{1}{y}}{y + \frac{1}{x}}$

8. $h \div \frac{(x+h)}{h}$

9. $\frac{(x-1)^3(2x-3) - (4x-1)(x-1)^2}{(x-1)^2(2x-1)}$

10. Find the partial fraction decomposition of:

$$\frac{x}{x^2 + 3x + 2}$$

II. Solving Equations

11. $1 - \frac{3}{x} = \frac{4}{5}$

12. $\frac{x+1}{3x-1} + \frac{2x+1}{3x-2} = -1$

13. $x^4 - 13x^2 + 37 = 7$

14. $x^3 - 4x^2 + x + 6 = 0$

III. Exponents and Logarithms

15. Solve for x : $\log_3(x-1) = 2$

16. Solve for x : $3^x \cdot 3^{x+1} = 9$

17. Solve for x : $e^{x-4} = 1$

18. Sketch the graph: $y = \log_2(x-1) + 3$

IV. Functions and Graphs

19. If $f(x) = \frac{x}{1-x}$, find $f\left(\frac{1}{x}\right)$

20. If $f(x) = \frac{x}{1-x}$, find $f(1-x)$

21. Sketch the graph of $y = \frac{3x}{x-1}$

22. Sketch the graph of $f(x) = \ln(x-1)$

23. Sketch the graph of $2y = \sqrt{36-9x^2}$

24. Sketch the graph of $f(x) = \begin{cases} \sqrt{4-x} & x \leq 0 \\ 2-3x & 0 < x \leq 2 \\ x^2 & x > 2 \end{cases}$

25. Sketch the graph of $f(x) = e^x$

26. Find the x and y intercepts of $y = \frac{x-1}{x+3}$

27. Find the domain of $f(x) = \frac{1}{\sqrt{3+2x}}$

28. Determine if the graph of $y = \frac{x^2}{x^2-4}$ is symmetrical with respect to the x-axis, the y-axis, or the origin.

29. Find all points of intersection of the graphs of $x^2 + 3x - y = 3$ and $x + y = 2$

30. Find an equation for the line passing through the point (4, -1) and parallel to the line $2x - 3y = 3$ (It's much easier if you use point-slope)

31. If the point (-1, 1) lies on the graph of the equation $kx^2 - xy + y^2 = 5$, find the value of k.

32. For the function $y = 5 - \sqrt{9 - x^2}$:

(a) What is the domain?

(b) What is the range?

(c) Is the function, odd, even, or neither?

33. For the function $y = 3^{-x} - 1$?

State the domain:

Range:

x-int.:

y-int:

34. Let $f(x) = \frac{1}{x+1}$ and $g(x) = x^2 - 5$. Find all values of x for which $f(g(x))$ is discontinuous.

V. Trigonometry

35. Graph $y = 2 \cos 3\theta - 1$

36. Find $\sin\left(\frac{7\pi}{6}\right)$

37. Evaluate $\tan\left(-\frac{5\pi}{3}\right)$

38. Evaluate $\cos^{-1}(-1)$

39. Solve: $\tan x = 2 \sin x$

40. Solve: $2 \sin^2 \theta - \cos \theta = 1$

VI. Limits

Find the following limits

41. $\lim_{x \rightarrow 2} \frac{(x-3)}{(x-4)}$

42. $\lim_{x \rightarrow \pi} \frac{\cos 2x}{\cos x}$

43. $\lim_{x \rightarrow -2} \frac{x+2}{x^2+5x+6}$

44. $\lim_{x \rightarrow 0} \frac{x}{5 \sin x}$

45. $\lim_{x \rightarrow 4} \frac{x-4}{|x-4|}$

46. $\lim_{x \rightarrow \infty} \frac{x^2 - x - 6}{5x^2}$

VII. Miscellaneous. Calculators are permitted for the following:

47. A business had annual retail sales of \$124,000 in 2003 and \$211,000 in 2006. Assuming that the annual increase in sales follows a linear pattern, predict the retail sales for 2017.

48. Suppose that in a given year, the population of a certain endangered species is reduced by 25%. If the population is now 7500, in how many years will the population be 4000?

49. (a) Graph the parameterized described by $x = 2\cos t$, $y = -3\sin t$, $0 \leq t \leq \pi$. Indicate the direction in which the curve is traced.

(b) Find a Cartesian equation for the parameterized curve.

50. Let $f(x) = \sqrt[3]{x+5}$ and $g(x) = x^3 - 5$. Which of the following are true? (Circle the correct one(s))

I. $g(x) = f^{-1}(x)$ for all real values of x .

II. $(f \circ g)(x) = 1$ for all real values of x .

III. The function f is one-to-one

51. $f(x)$ decreases without bound as x approaches

what value from the right?

$$f(x) = \frac{4}{(x-3)(5-x)}$$

52. Find all vertical asymptotes of

$$\frac{x+1}{x^2-1}$$

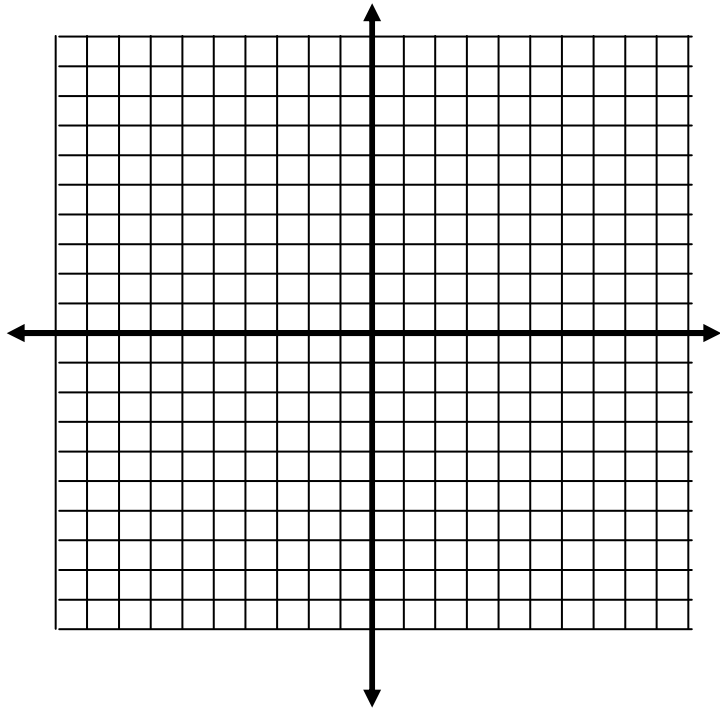
Find the derivative of the following equations:

53. $y = 7x^3 - 5x^2 + 10x - 9$

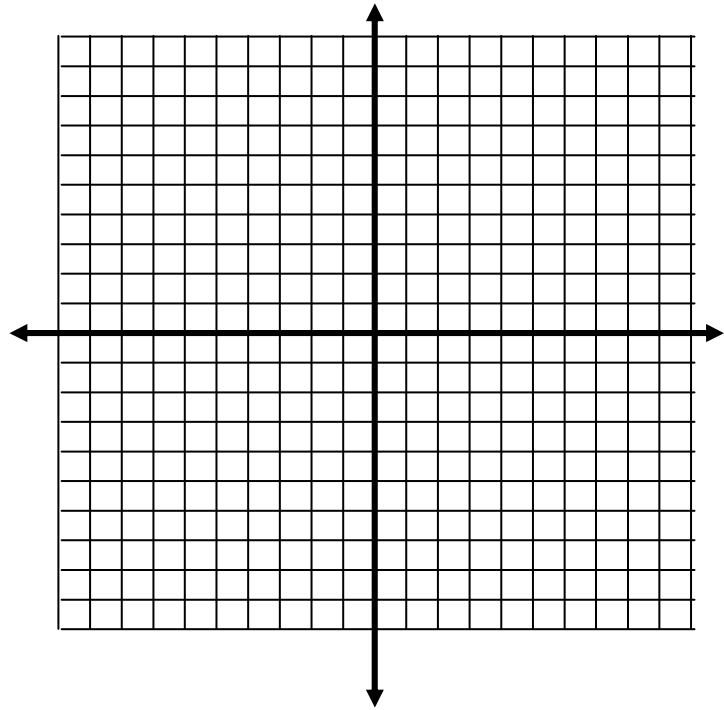
54. $y = \frac{x-5}{2x^2+3}$

55. $y = e^x \cos x$

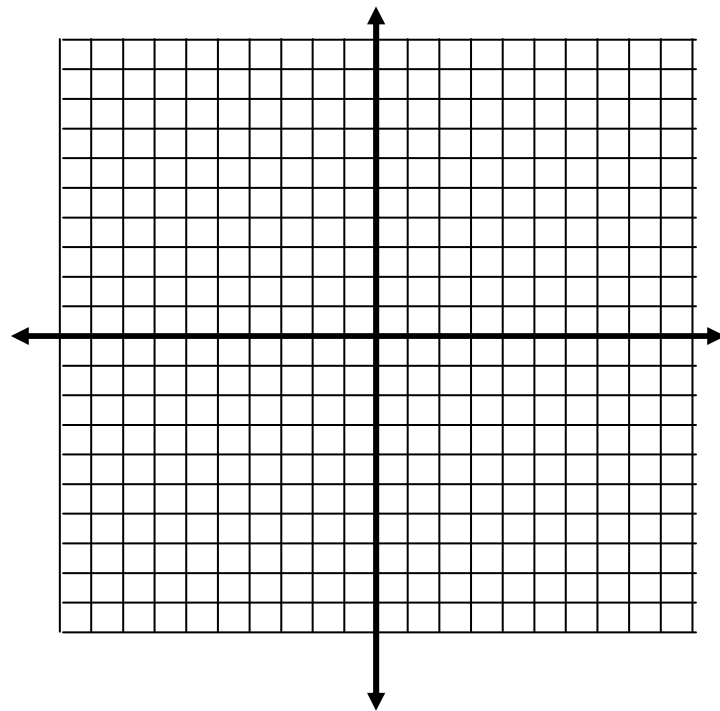
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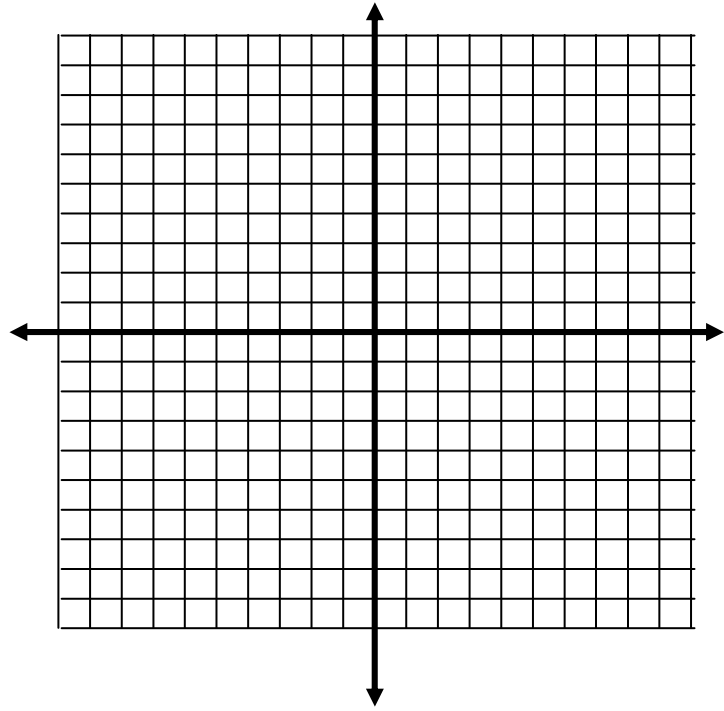
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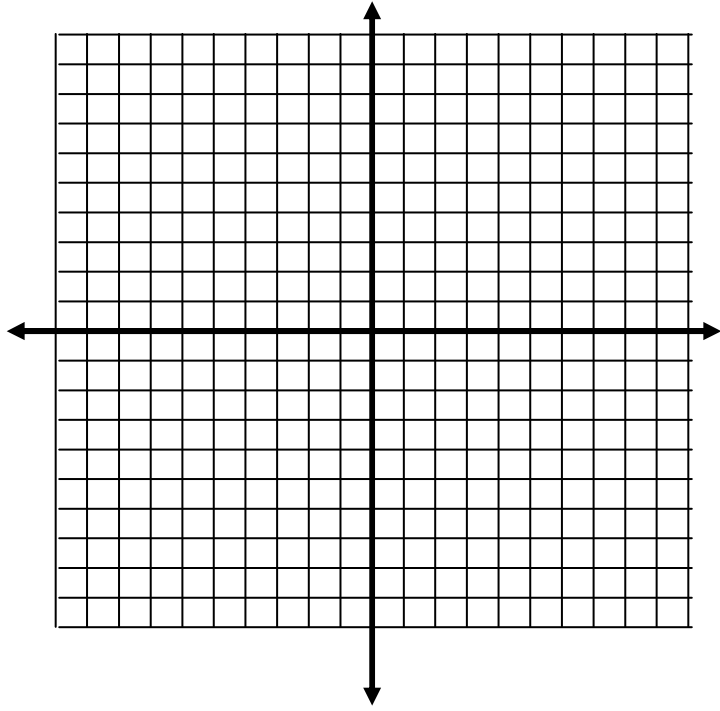
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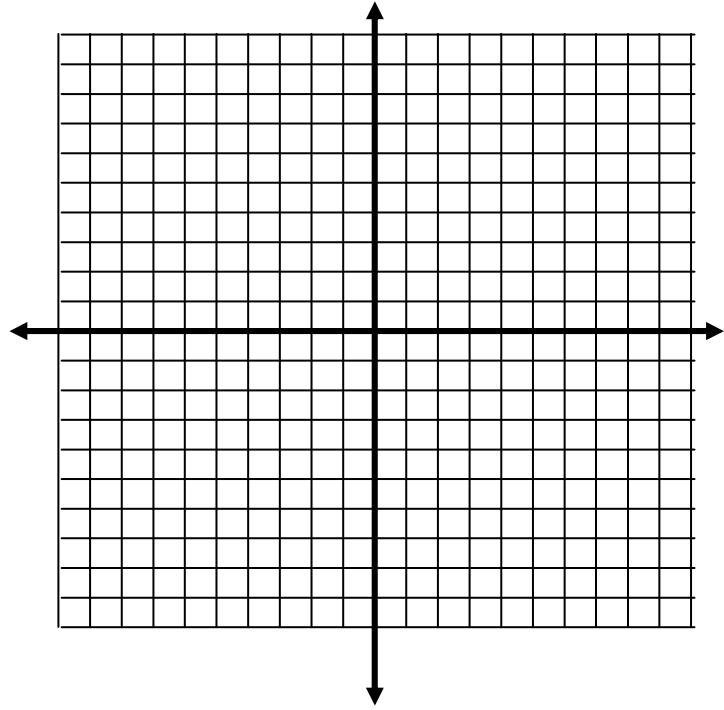
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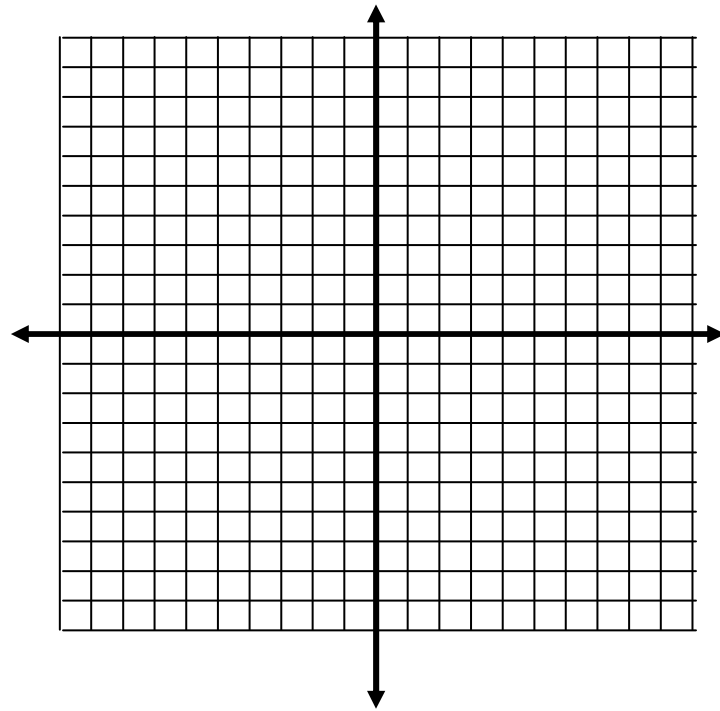
24.



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35.



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