

Name \_\_\_\_\_

## Students Entering AP Calculus AB, Summer 2019 Packet

When you go into AP calculus, we assume you have certain mathematical skills that were taught to you in previous years. If you do not have these skills, you will find that you will consistently get problems incorrect next year, even though you understand the calculus concepts. It is frustrating for students when they are tripped up by the algebra and not the calculus. This summer packet is intended for you to brush up and possibly relearn these topics.

Answer all questions without a calculator!!

It is a mistake to decide to do this now. Let it go until mid-summer. I want these techniques to be relatively fresh in your mind in the fall. Also, don't fake your way through these problems; instead, visit the websites suggested below, or send me an email with specific questions.

(max\_malossini@sdst.org). The whole packet will take you about two weeks to complete.

I expect you to try hard at reviewing this material, to look things up, watch video lessons, and then complete this practice.

Answers will be shared on the first and second day of school. On those days you will have a chance to ask questions, complete some of the problems, and then hand it in [you may attach extra paper to show your work].

Your first two quizzes will be made with questions from this packet.

<http://www.khanacademy.com>

<http://www.purplemath.com/modules/index.htm>

<http://www.hippocampus.org/?select-textbook=19>

<http://tutorial.math.lamar.edu/Classes/Alg/Alg.aspx>

Have a good summer and see you in the fall,

Mr. Malossini

This practice is divided in four sections:

1. Simplify expressions
2. Evaluate functions
3. Solve equations
4. Basic functions and operations

It is crucial that you do not use a calculator for any of these questions.

### 1. Simplify each expression

a.  $\frac{x^3 - 9x}{x^2 - 7x + 12}$

b.  $2\ln(x + 3) - \ln(x)$

c.  $\frac{x^3}{x^{-5}}$

d.  $\frac{\frac{1}{x} - \frac{1}{5}}{\frac{1}{x^2} - \frac{1}{25}}$

e.  $\frac{4 - x}{x^2 - 16}$

f.  $\frac{x}{\sqrt{x}}$

g.  $\frac{1}{x+h} - \frac{1}{x}$

h.  $x^{\frac{3}{2}}\left(x + x^{\frac{5}{2}} - x^2\right)$

i.  $\frac{2}{\sqrt{3}}$

j.  $\frac{a^{-1}}{a^{-2}\sqrt{a}}$

k.  $\sin^2 x + \cos^2 x$

l.  $1 - \sec^2 x$

m.  $\sin^4 x - \cos^4 x$

n.  $e^{3\ln x}$

o.  $\tan x \cos x$

p.  $\frac{\sin(2x) - \sin x}{2\cos x - 1}$

q.  $2\ln(\sqrt{1-x})$

r.  $\sqrt{2x-3} - \frac{1}{\sqrt{2x-3}}$

**2. Evaluate each quantity and write in simplest form**

$$\sin(\pi)$$

$$\cos(\pi)$$

$$\tan(\pi)$$

$$\sin\left(\frac{\pi}{3}\right)$$

$$\cos\left(\frac{\pi}{6}\right)$$

$$\tan\left(-\frac{3\pi}{4}\right)$$

$$\sin\left(\frac{4\pi}{3}\right)$$

$$\cot\left(\frac{\pi}{3}\right)$$

$$\csc\left(\frac{5\pi}{4}\right)$$

$$\cos\left(-\frac{\pi}{3}\right)$$

$$\cos\left(\sin^{-1}\left(\frac{1}{2}\right)\right)$$

$$\sin^{-1}\left(\sin\frac{\pi}{7}\right)$$

$$\sec\left(-\frac{2\pi}{3}\right)$$

$$\cos\left(\frac{7\pi}{4}\right)$$

$$\sin\left(\frac{5\pi}{2}\right)$$

$$\csc\left(\frac{5\pi}{6}\right)$$

$$\cos^{-1}\left(\tan\frac{\pi}{4}\right)$$

$$\tan\left(\frac{2\pi}{3}\right)$$

$$e^{\ln 5}$$

$$\ln 1$$

$$27^{\frac{2}{3}}$$

$$\ln e^7$$

$$\sqrt[3]{8}$$

$$16^{\frac{3}{4}}$$

$$e^0$$

$$\ln(\sqrt{e})$$

$$1^{4.2}$$

**3. Solve each equation/inequality for x (give exact values only; solve trig equations on  $[0, 2\pi]$  )**

**a.**  $5^{x+1} = 25$

**b.**  $\frac{1}{3} = 3^{2x+2}$

**c.**  $\log_2 x = 3$

**d.**  $\log_3 x^2 = 2\log_3 4 - 4\log_3 5$

**e.**  $\frac{2}{x+1} = \frac{x-2}{2}$

**f.**  $x^2 - 6x + 9 = 0$

**g.**  $\frac{1}{x} + x = 4$

**h.**  $\frac{5}{e^x + 1} = 1$

**i.**  $\sqrt{x-1} - \frac{5}{\sqrt{x-1}} = 0$

**j.**  $3\cos x - 1 = 2$

**k.**  $2\sin(2x) - \sqrt{3} = 0$

**l.**  $\tan x(2\cos^2 x - 1) = 0$

**m.**  $\sec x = 2$

**n.**  $\ln(x+1) = 2$

**o.**  $\ln(e^x) = 4$

**p.**  $\ln x + 2\ln x = 0$

**q.**  $\ln 6 + \ln(x) - \ln 2 = 3$

**r.**  $4xy - 2y^2 = 2x$

**s.**  $e^{2x-5} = 1$

**t.**  $\frac{x^4 - 1}{x^3} = 0$

**u.**  $(x+3)(x-3) > 0$

**v.**  $|x-3| \leq 6$

**w.**  $x^3 + 4x^2 - 5x < 0$

**x.**  $\frac{x+2}{x} \geq 0$

**y.**  $|5x-2| \geq 25$

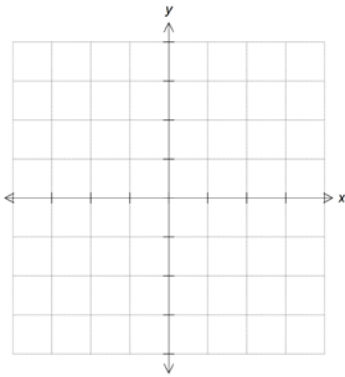
**z.**  $\sqrt{x+3} = x-9$

#### 4. Basic functions: graphs and operations

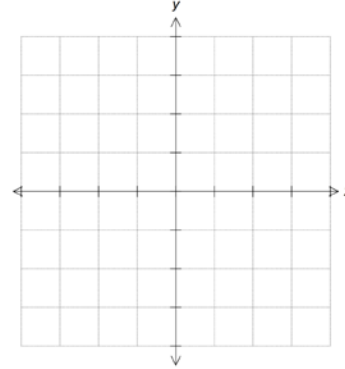
Calculus is a lot easier when you are familiar with several basic functions.  
For each function listed below, you should be able to quickly and accurately:

- sketch its graph
- identify domain, range, intercepts, asymptotes...
- perform basic transformations (shifts, stretches, reflections)

a.  $y = \sqrt{x}$

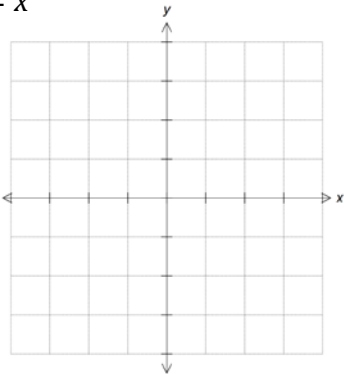


b.  $y = \sqrt[3]{x}$

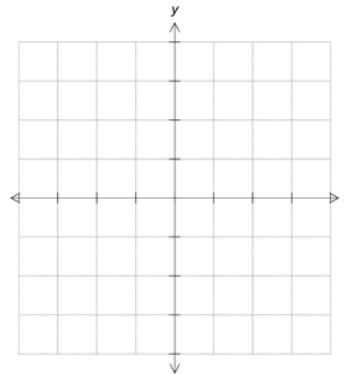


c.  $y = x^2$

$y = x^3$

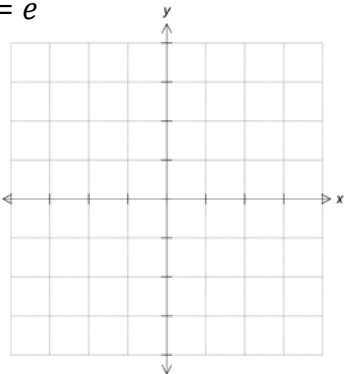


d.  $y = \frac{1}{x}$

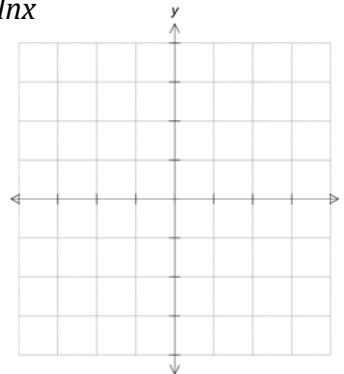


e.  $y = e^x$

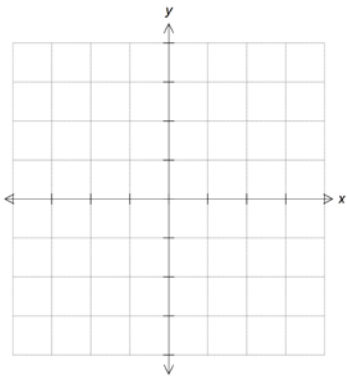
$y = e^{-x}$



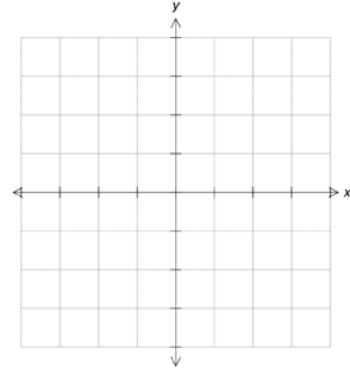
f.  $y = \ln x$



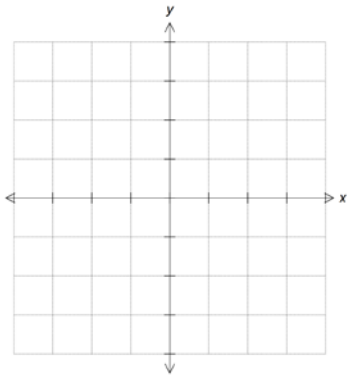
**g.**  $y = \sin x$



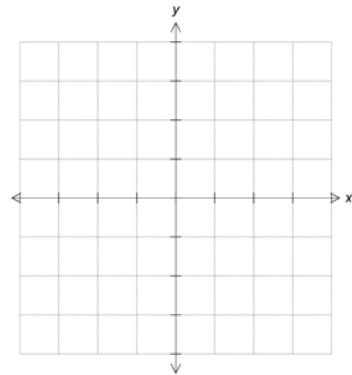
**h.**  $y = \cos x$



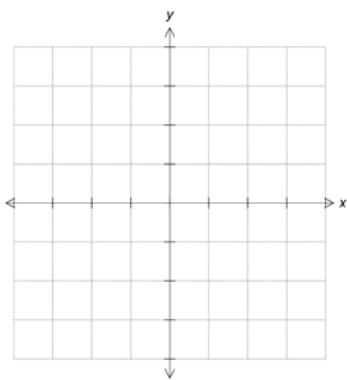
**i.**  $y = \tan x$



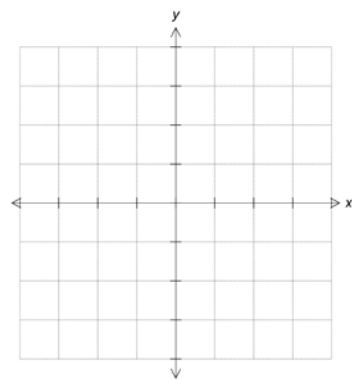
**j.**  $y = \sec x$



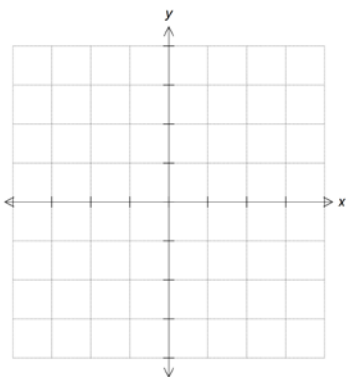
**k.**  $y = \csc x$



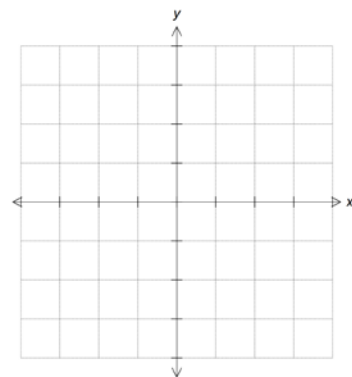
**l.**  $y = \cot x$



**m.**  $y = \begin{cases} \sin x & x < 0 \\ x^2 & x \geq 0 \end{cases}$



**n.**  $y = \begin{cases} x + 1 & x < -1 \\ x^2 - 1 & -1 < x < 1 \\ 2 - x & x \geq 1 \end{cases}$



## Operations with functions

**o.** Find the inverse of each function (is  $f^{-1}(x)$  a function? Why? Why not?)

$$f(x) = 2\sqrt{3x-1}$$

$$f(x) = \frac{3}{x+2}$$

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

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**p.** Given  $f(x) = \sqrt{x+1}$  and  $g(x) = 3x^2 - 2x$  evaluate and simplify the following:

$$g(a+b) =$$

$$f(x-3) =$$

$$f(g(x)) =$$

$$g(f(x)) =$$

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**q.** Linear functions: find the equation of a line given each condition

- The line with slope 2 passing through (-3,1)
- The line parallel to  $3x - y + 1 = 0$  and passing through the origin
- The line that forms a  $45^\circ$  angle with the x-axis and passes through (1,2)
- The line that is perpendicular to  $y = \frac{1}{4}x + 1$  and is passing through (3,0)
- The line passing through points (-1,1) and (3,-1)
- The line with slope 2 that forms a triangle of area 12 with the positive x- and y-axis

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**r.** Find the domain of each function

$$y = \sqrt{x+5}$$

$$y = \frac{3x}{x-1}$$

$$y = 2^{3-x}$$

$$y = \ln(x+2)$$

$$y = \tan(2x)$$

$$y = \cos(\pi x)$$
  
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s. Show work to determine if each relation is even, odd, or neither.

$$f(x) = 2x^2 - 1$$

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

$$f(x) = x - \frac{1}{x}$$

$$f(x) = x^2 + 2x - 4$$

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s. Find the equation of each vertical and horizontal asymptote (if any)

$$f(x) = \frac{x+2}{2x-1}$$

$$f(x) = \frac{3x}{x^2 + x - 2}$$

$$f(x) = \frac{x^3 + 5x^2}{x^2 + 9}$$

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

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t. Describe (and graph) each transformation when compared to the parent graph:

$$y = \sqrt{x-2} + 3$$

$$y = \sin(2x)$$

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

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

$$y = (x-5)^2 - 2$$

$$y = \ln(-x)$$

----- **The End** -----