Name: ____

AP Calculus AB Summer Assignment

2025-2026

Part 1: Review of Algebra, Geometry & Trigonometry Worksheet Packet

Part 2: Limits and Continuity.

- Going into AP Calculus, there are certain math skills necessary to be successful for the year and ultimately on the AP exam. This assignment has been designed for you to review, relearn, or learn those topics so that you will be ready to learn calculus. I have included websites to refer to if you need help.

- Don't fake your way through any of these problems because you will need to understand everything in this very well. If you do not fully understand the topics in this packet, you may get calculus problems wrong in the future, not because you do not understand the calculus concept, but because you do not understand the algebra or trigonometry behind it.

- This will count as our first test grade for marking period 1.

- For this packet, you must show all of your work and do not rely on a calculator to do all of the work for you. Half of the AP exam does not allow any calculator at all.
  - If you need to do some work on a separate piece of paper, please attach it when you are done.

- **DUE Wednesday September** 3, 2025

AP Calculus Summer Assignment Part 1

◆Skill A Writing an equation of a line in slope-intercept form

Recall The slope-intercept form of a line is $y = mx + b$.

$$y = \underset{\text{slope}}{\underset{\uparrow}{m}}x + \underset{y\text{-intercept}}{\underset{\uparrow}{b}}$$

◆ **Example**

Write an equation for each line.

a. containing (0, 1) and with a slope of -2

b. containing (3, -4) and (9, 0)

◆ **Solution**

a. The slope, m, is given as -2. The line contains (0, 1), so this point is the y-intercept, or b is 1. Substituting these numbers into the equation gives $y = -2x + 1$.

b. First find the slope. $m = \frac{-4 - 0}{3 - 9} = \frac{-4}{-6} = \frac{2}{3}$

Then subtitute the coordinates of one of the given points into the equation and solve for b.

For the point (9, 0): $0 = \frac{2}{3}(9) + b$

$0 = 6 + b$

$b = -6$

Substituting this number for b and $\frac{2}{3}$ for m into the equation $y = mx + b$ gives the equation $y = \frac{2}{3}x - 6$.

For each equation, find the slope and the y-intercept.

1. $y = 3x - 1$ ____________ **2.** $y = \frac{1}{2}x + 2$ ____________ **3.** $y = -x + \frac{1}{2}$ ____________

Write an equation in slope-intercept form for each line.

4. with a slope of 2 and a y-intercept of -1 ____________________

5. containing (0, -3) and with a slope of $\frac{1}{3}$ ____________________

Write an equation in slope-intercept form for the line that contains each pair of points.

6. (1, 1) and (3, 5) ____________ **7.** (2, -4) and (-1, 5) ____________

◆Skill B Writing an equation of a line in point-slope form

Recall The point-slope form for an equation of a line is $y - y_1 = m(x - x_1)$.

◆ **Example**

Write an equation for the line through (1, −1) and (−1, 5)

a. in point-slope form.

b. in slope-intercept form.

◆ **Solution**

a. First find m.

$$m = \frac{\text{difference in } y\text{-values}}{\text{difference in } x\text{-values}} = \frac{-1 - 5}{1 - (-1)} = \frac{-6}{2} = -3$$

Substitute the slope and one of the points into the point-slope equation.

$y - y_1 = m(x - x_1)$

$y - (-1) = -3(x - 1)$ Use the point (1, −1).

$y + 1 = -3(x - 1)$ Simplify.

b. Rewrite the equation in the form $y = mx + b$.

$y + 1 = -3(x - 1)$

$y + 1 = -3x + 3$ Distributive Property

$y = -3x + 2$ Subtract 1 from each side.

Write an equation for each line in point-slope form.

1. containing (4, −1) and with a slope of $\frac{1}{2}$ ______

2. crossing the x-axis at $x = -3$ and the y-axis at $y = 6$ ______

3. containing the points (−6, −1) and (3, 2) ______

Rewrite each equation in slope-intercept form.

4. the line from Exercise 7 ______

5. the line from Exercise 8 ______

6. the line from Exercise 9 ______

7. In what situations would you find it easier to use point-slope form, and in what situations would you find it easier to use slope-intercept form? ______

______

◆Skill B Find the zeros of a polynomial function by factoring

Recall The zeros of a function are the values of x that make y equal to 0.

Solve by factoring.

1. $x^2 - 4x - 12 = 0$

____

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

____

3. $x^2 - 9x + 14 = 0$

____

4. $9x^2 - 1 = 0$

____

5. $4x^2 + 4x + 1 = 0$

____

6. $x^2 - 36 = 0$

____

Use the quadratic formula to solve each equation.

1. $x^2 - 5x + 4 = 0$

2. $x^2 - 2x - 24 = 0$

◆Skill A Using the four basic operations on functions to write new functions

Recall To write the sum, difference, product, or quotient of two functions, f and g, write the sum, difference, product, or quotient of the expressions that define f and g. Then simplify.

◆ Example

Let $f(x) = x^2 + 3x + 2$ and $g(x) = 5x - 1$. Write an expression for each function.

a. $(f + g)(x)$ **b.** $(f - g)(x)$ **c.** $(fg)(x)$ **d.** $\left(\frac{f}{g}\right)(x)$

◆ Solution

a. $(f + g)(x) = f(x) + g(x)$
$= (x^2 + 3x + 2) + (5x - 1)$
$= x^2 + 8x + 1$ *Combine like terms.*

b. $(f - g)(x) = f(x) - g(x)$
$= (x^2 + 3x + 2) - (5x - 1)$
$= x^2 + 3x + 2 - 5x + 1$
$= x^2 - 2x + 3$ *Combine like terms.*

c. $(fg)(x) = f(x) \cdot g(x)$
$= (x^2 + 3x + 2)(5x - 1)$
$= (x^2 + 3x + 2)(5x) + (x^2 + 3x + 2)(-1)$ *Distributive Property*
$= 5x^3 + 15x^2 + 10x - x^2 - 3x - 2$
$= 5x^3 + 14x^2 + 7x - 2$

d. $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$, where $g(x) \neq 0$
$= \frac{x^2 + 3x + 2}{5x - 1}$, where $x \neq \frac{1}{5}$

Let $f(x) = 5 - \frac{2x}{3}$ and $g(x) = \frac{1}{2}x^2 + 3x$. Evaluate each function.

3. $f(1) + g(0)$ ______________________

4. $g(4) - f(5)$ ______________________

5. $f(0) \cdot g(0)$ ______________________

6. $g(-6) \cdot f(-6)$ ______________________

Let $f(x) = 3x^2 + 2$, $g(x) = 2x - 1$, and $h(x) = x^2 + 5x$. Find each new function, and state any domain restrictions.

1. $(f + g)(x)$

____

2. $(f - h)(x)$

____

3. $(h - g)(x)$

____

4. $(gh)(x)$

____

5. $(hg)(x)$

____

6. $(f + h)(x)$

____

7. $\left(\frac{f}{g}\right)(x)$

____

8. $\left(\frac{h}{g}\right)(x)$

____

◆Skill B Finding the composite of two functions

Recall To write an expression for the composite function $(f \circ g)(x)$, replace each x in the expression for f with the expression defining g. Then simplify the result.

◆ **Example**

Let $f(x) = 5x$ and $g(x) = 2x^2 - 3$. Find $(f \circ g)(2)$ and $(g \circ f)(2)$. Then write expressions for $(f \circ g)(x)$ and $(g \circ f)(x)$.

◆ **Solution**

$(f \circ g)(2)$: $g(2) = 2(2)^2 - 3 = 5$ $f(g(2)) = f(5) = 5(5) = 25$

Thus, $(f \circ g)(2) = 25$.

$(g \circ f)(2)$: $f(2) = 5(2) = 10$ $g(f(2)) = g(10) = 2(10)^2 - 3 = 197$

Thus, $(g \circ f)(2) = 197$.

To write expressions for $(f \circ g)(x)$ and $(g \circ f)(x)$, use the variable x instead of a particular number.

$$(f \circ g)(x) = f(g(x)) = f(2x^2 - 3) = 5(2x^2 - 3) = 10x^2 - 15$$

$$(g \circ f)(x) = g(f(x)) = g(5x) = 2(5x)^2 - 3 = 50x^2 - 3$$

Let $f(x) = x^2 - 1$, $g(x) = 3x$, and $h(x) = 5 - x$. Find each composite function.

1. $(f \circ g)(x)$ ____________

2. $(g \circ f)(x)$ ____________

3. $(h \circ f)(x)$ ____________

4. $(h \circ g)(x)$ ____________

5. $(g \circ g)(x)$ ____________

6. $(h \circ h)(x)$ ____________

7. $(g \circ h)(4)$ ____________

8. $(f \circ f)(-3)$ ____________

9. $(f \circ (g \circ h))(1)$ ____________

10. $(g \circ (g \circ g))(5)$ ____________

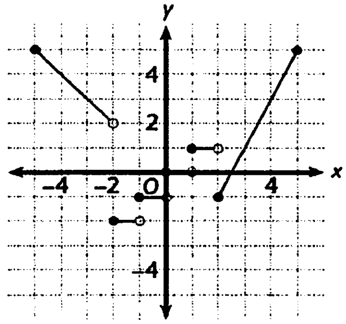
Ans) 9. 143 10. 135

Skill B Graphing piecewise, step, and absolute-value functions

Recall A piecewise function in x is a function defined by different expressions in x on different intervals for x.

◆ **Example**
Graph this piecewise function.

$$f(x) = \begin{cases} |x|, & \text{if } -5 \le x < -2 \\ [x], & \text{if } -2 \le x < 2 \\ 2x - 5, & \text{if } 2 \le x \le 5 \end{cases}$$



◆ **Solution**

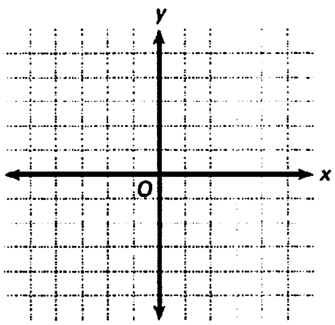
x	-5	-4	-3	-2.5
$y = \lvert x \rvert$	5	4	3	2.5

x	-2	-1.5	-1	-0.5	0	1
$y = [x]$	-2	-2	-1	-1	0	1

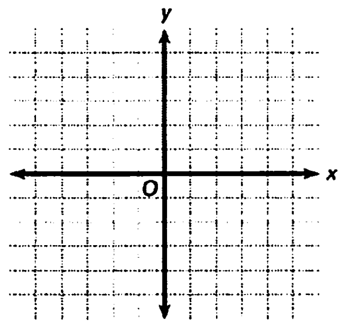
x	2	2.5	3	4	5
$y = 2x - 5$	2	0	1	3	5

Graph each function.

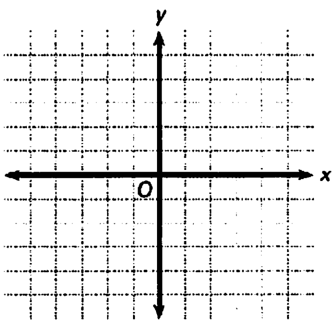
1. $f(x) = \begin{cases} x + 3, \text{ if } x < 0 \\ -2x + 5 \text{ if } x \ge 0 \end{cases}$



2. $f(x) = \begin{cases} \frac{1}{2}x \text{ if } -4 \le x \le 2 \\ 2x - 3 \text{ if } x > 2 \end{cases}$



3. $f(x) = \begin{cases} |x| \text{ if } x \le 1 \\ 2 - |x - 2| \text{ if } x > 1 \end{cases}$



Skill IV Using logarithms to solve exponential equations

Recall The common logarithm, $\log_{10} x$, is usually written as $\log x$.

◆ **Example**

Solve each equation.

a. $3^x = 81$ **b.** $5^x = 75$ **c.** $7^{x+1} = 150$

◆ **Solution**

a. $3^x = 81$

Since 81 is a power of 3, use powers of 3.

$3^x = 3^4$

$x = 4$ *One-to-One Property of Exponential Functions*

b. $5^x = 75$

Since 75 is not a power of 5, use logarithms to solve this equation.

$\log 5^x = \log 75$

$x \log 5 = \log 75$ *Power Property of Logarithms*

$x = \frac{\log 75}{\log 5}$

$x \approx 2.68$

Check: $5^{2.68} \approx 75$

c. $7^{x+1} = 150$

$\log 7^{x+1} = \log 150$

$(x+1)\log 7 = \log 150$

$x + 1 = \frac{\log 150}{\log 7}$

$x = \frac{\log 150}{\log 7} - 1$

$x \approx 1.57$

$\log_7 938 = \frac{\log 938}{\log 7} \approx \frac{2.972}{.845} \approx$ $\boxed{3.52}$

→ Use common log button on calculator to find these values.

Solve each equation. Round your answers to the nearest hundredth.

4. $7^x = 80$ ________

5. $2^{x-3} = 25$ ________

6. $3^{x+4} = 27$ ________

7. $6^{2x-7} = 216$ ________

8. $5^{3x-1} = 49$ ________

9. $10^{x+5} = 125$ ________

Evaluate each logarithmic expression to the nearest hundredth.

10. $\log_6 18$

11. $\log_5 100$

12. $\log_2 400$

Skill C Using the inverse functions $f(x) = e^x$ and $g(x) = \ln x$ to solve equations

Recall $\ln e$ is the base e logarithm of x. Therefore, $\ln e = 1$, just like $\log 10 = 1$ (base 10).

◆ **Example 1**

Simplify each expression.

a. $e^{\ln 4}$ **b.** $\ln e^2$

◆ **Solution**

a. Since $y = e^x$ and $y = \ln x$ are inverse functions, $e^{\ln x} = x$. So, $e^{\ln 4} = 4$.

b. Because of inverse functions, $\ln e^x = x$. So $\ln e^2 = 2$.

◆ **Example 2**

Solve for x.

a. $2e^{2x+1} = 60$ **b.** $\ln x = 3.2$

◆ **Solution**

a.
$$2e^{2x+1} = 60$$
$$e^{2x+1} = 30$$
$$\ln e^{2x+1} = \ln 30$$
$$2x + 1 = \ln 30$$
$$x = \frac{\ln 30 - 1}{2}$$
$$x \approx 1.20$$

b.
$$\ln x = 3.2$$
$$e^{\ln x} = e^{3.2}$$
$$x \approx e^{3.2}$$
$$x \approx 24.53$$

Simplify each expression.

1. e^{ln4} =
2. $\ln e^5$ =
3. $5e^{ln3}$ =
4. $4 + lne^2$ =

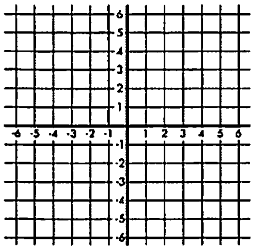
Solve each equation for *x* by using the natural logarithmic function.

7. $e^x = 34$ **8.** $3e^x = 120$ **9.** $e^x - 8 = 51$

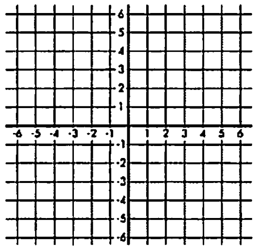
10. $\ln x = 2.5$ **11.** $\ln(3x - 2) = 2.8$ **12.** $\ln e^x = 5$

Graph each parent function.

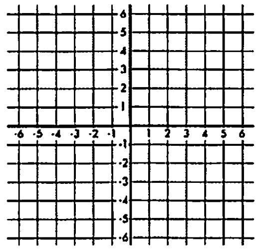
$y = x^2$



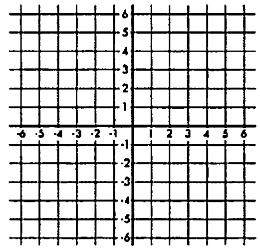
$y = x^3$



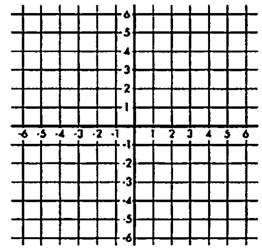
$y = e^x$



$y = \ln(x)$



$y = |x|$



Describe the transformations of the parent functions included in each equation.

1. $y = -3|x + 2| - 3$ ______________________________

____

____

2. $y = 2(x - 3)^2 + 1$ ______________________________

____

____

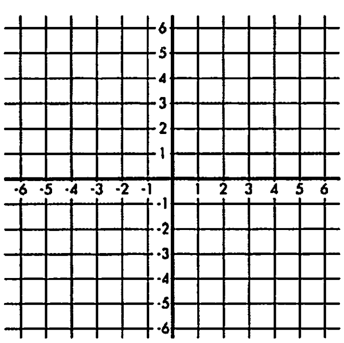
3. $y = 4|x - 1| + 2$ ______________________________

____

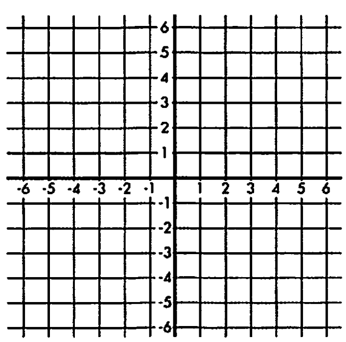
____

Graph the following functions.

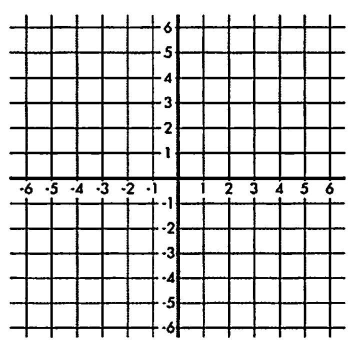
$y = 3(x - 1)^2 - 2$



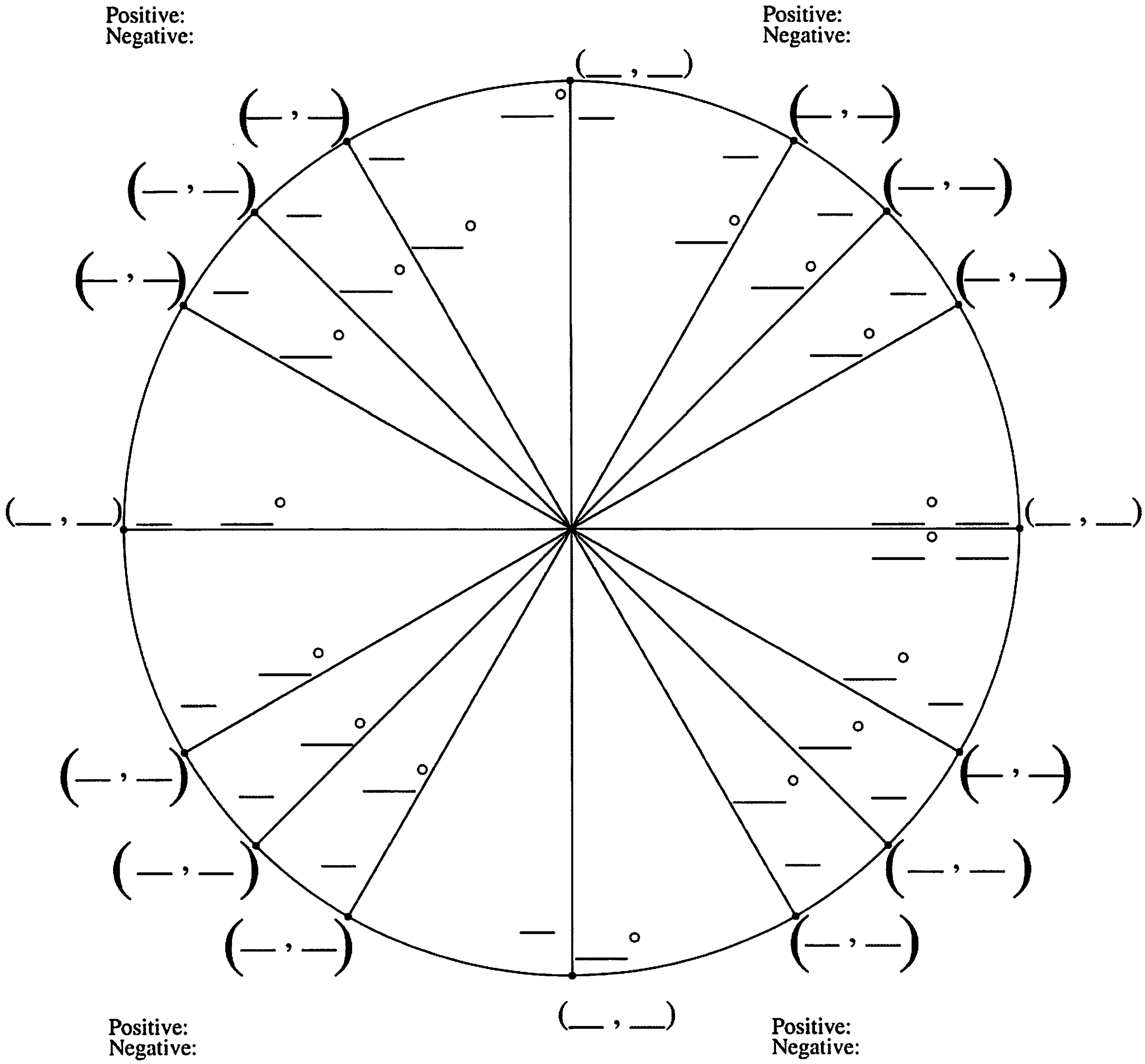
$y = -2|x + 1| - 4$



$y = 3x^2 - 4$



Fill in The Unit Circle



Try to do these problems without your unit circle! DO NOT use a calculator.

Evaluate each expression. Give exact answers.

1. $\sin\frac{3\pi}{4}$ ______ **2.** $\cos\frac{2\pi}{3}$ ______ **3.** $\tan\frac{5\pi}{6}$ ______

4. $\cos\left(-\frac{7\pi}{6}\right)$ ______ **5.** $\tan\left(-\frac{\pi}{4}\right)$ ______ **6.** $\sin\pi$ ______

Find each trigonometric value. Give exact answers.

1. $\sin 120°$ ______ **2.** $\cos 330°$ ______ **3.** $\tan 225°$ ______ **4.** $\cos 150°$ ______

5. $\sin 240°$ ______ **6.** $\sin 150°$ ______ **7.** $\tan 315°$ ______ **8.** $\cos 225°$ ______

Convert the following degree measures to radian measures. Give exact answers.

1. $270°$ ______ **2.** $45°$ ______ **3.** $225°$ ______

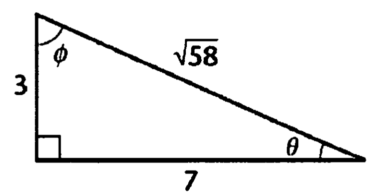
4. $210°$ ______ **5.** $-90°$ ______ **6.** $-300°$ ______

Convert each of the following radian measures to degree measures.

7. $\frac{\pi}{4}$ ______ **8.** $\frac{3\pi}{2}$ ______ **9.** $\frac{5\pi}{6}$ ______

10. $\frac{5\pi}{3}$ ______ **11.** -3π ______ **12.** $-\frac{11\pi}{6}$ ______

Refer to the triangle at right to find each value. Give exact answers.



1. $\sin\theta$ ______ **2.** $\cos\theta$ ______

3. $\tan\theta$ ______ **4.** $\csc\theta$ ______

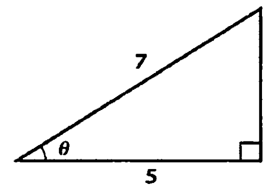
5. $\sec\theta$ ______ **6.** $\cot\theta$ ______ **7.** $\sin\phi$ ______

8. $\cos\phi$ ______ **9.** $\tan\phi$ ______ **10.** $\csc\phi$ ______

Skill Z Using inverse trigonometric functions to find the measure of an acute angle

Recall The statements $\tan\theta = \frac{5}{7}$ and $\theta = \tan^{-1}\left(\frac{5}{7}\right)$ are equivalent.

◆ **Example**
In the triangle shown at right, find the measure of θ to the nearest whole degree.



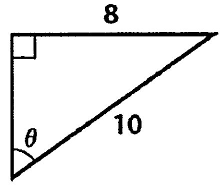
◆ **Solution**
Since the **hypotenuse** and the side **adjacent** to θ are given, use the cosine function.

$$\cos\theta = \frac{\text{adj.}}{\text{hyp.}} = \frac{5}{7}$$

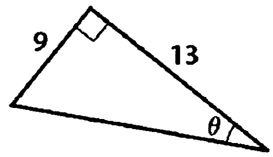
$\theta = \cos^{-1}\left(\frac{5}{7}\right) \approx 44°$ *Use your calculator in **degree** mode.*

Find θ to the nearest degree in each triangle.

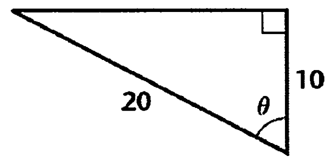
1.



2.

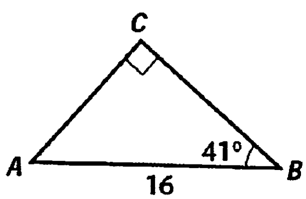


3.

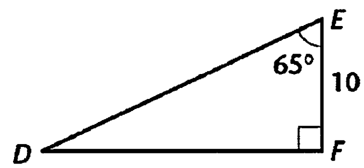


Solve each triangle. Round each angle measure to the nearest degree and each side length to the nearest tenth.

14.



15.



Skill A Evaluating inverse trigonometric relations and functions

Recall The domain and range of a function become the range and domain respectively, of the inverse.

◆ **Example 1**

Find each value. Give answers in degrees and radians.

a. $\text{Sin}^{-1}\left(\frac{\sqrt{3}}{2}\right)$ **b.** $\text{Cos}^{-1}\left(-\frac{1}{2}\right)$ **c.** $\text{Tan}^{-1}(-1)$

◆ **Solution**

a. Since $\sin 60° = \frac{\sqrt{3}}{2}$, then $\text{Sin}^{-1}\left(\frac{\sqrt{3}}{2}\right) = 60°$ or $\frac{\pi}{3}$ radians.

Notice that although other angles have a sine of $\frac{\sqrt{3}}{2}$, you must choose an angle that is between $-90°$ and $90°$ in order to have a value in the appropriate range.

b. Since $\cos 120° = -\frac{1}{2}$, then $\text{Cos}^{-1}\left(-\frac{1}{2}\right) = 120°$ or $\frac{2\pi}{3}$ radians.

c. Since $\tan(-45°) = -1$, then $\text{Tan}^{-1}(-1) = -45°$ or $-\frac{\pi}{4}$ radians.

◆ **Example 2**

Evaluate each expression.

a. $\sin\left(\text{Cos}^{-1}\left(\frac{1}{2}\right)\right)$ **b.** $\text{Tan}^{-1}(\sin 90°)$

◆ **Solution**

a. Begin inside the parentheses.

$\text{Cos}^{-1}\left(\frac{1}{2}\right) = 60°$

So, $\sin\left(\text{Cos}^{-1}\left(\frac{1}{2}\right)\right) = \sin 60° = \frac{\sqrt{3}}{2}$

b. $\sin 90° = 1$

Therefore, $\text{Tan}^{-1}(\sin 90°) = \text{Tan}^{-1}(1)$

$= 45°$ or $\frac{\pi}{4}$ radians

Find each value. Give answers in degrees and in radians. (It may be helpful to review what you learned about 30°-, 45°-, and 60°-angles.)

1. $\text{Sin}^{-1}\left(\frac{1}{2}\right)$ ____________ **2.** $\text{Cos}^{-1}\left(-\frac{1}{\sqrt{2}}\right)$ ____________ **3.** $\text{Tan}^{-1}(\sqrt{3})$ ____________

4. $\text{Sin}^{-1}(-1)$ ____________ **5.** $\text{Cos}^{-1}\left(\frac{\sqrt{3}}{2}\right)$ ____________ **6.** $\text{Tan}^{-1}(-1)$ ____________

Evaluate each composite trigonometric expression.

7. $\tan\left(\text{Cos}^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)$ ________ **8.** $\cos\left(\text{Sin}^{-1}\left(\frac{1}{\sqrt{2}}\right)\right)$ ________ **9.** $\sin\left(\text{Tan}^{-1}\left(-\frac{1}{\sqrt{3}}\right)\right)$ ________

Simplify the Trig Expression.

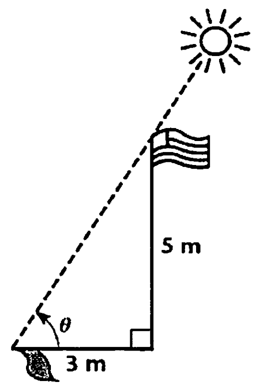
1. $(1 + \sin x)(1 - \sin x)$ **2.** $\sin x \sec x \cot x$

Skill B Applying inverse trigonometric functions

Recall $\sin\theta = \frac{\text{opp.}}{\text{hyp.}}$ $\cos\theta = \frac{\text{adj.}}{\text{hyp.}}$ $\tan\theta = \frac{\text{opp.}}{\text{adj.}}$

◆ **Example**

At a certain time of the day, the 5 meter flagpole shown at right casts a shadow that is 3 meters long. What is the angle of elevation of the sun at this time?



◆ **Solution**

Since 3 meters is the length of the side **adjacent** to θ and 5 meters is the length of the side **opposite** θ, use the tangent function.

$\tan\theta = \frac{5}{3}$

$\theta = \tan^{-1}\left(\frac{5}{3}\right)$

This last equation states that θ is the angle that has a tangent of $\frac{5}{3}$.

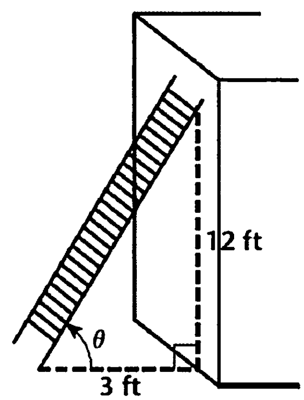
$\theta \approx 59°$ *Use calculator in degree mode.*

Find the measure of each angle to the nearest whole degree.

1. Find the measure of the smallest angle in a right triangle with sides of 3, 4, and 5 centimeters. ____________

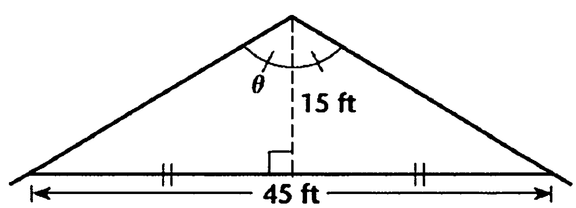
2. What is the angle between the bottom of the ladder and the ground as shown at right?

____



3. Find the angle at the peak of the roof as shown at right.

____



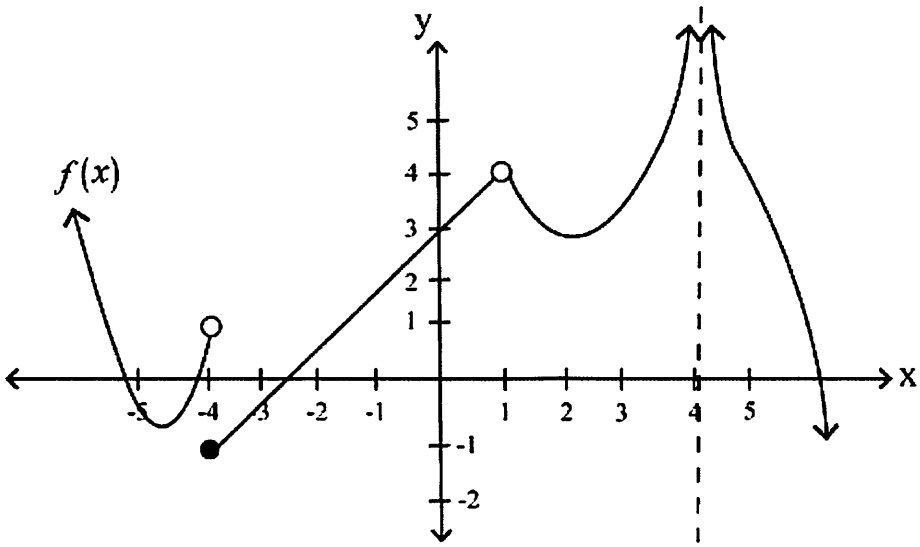
4. The hypotenuse of a right triangle is 3 times as long as the shorter leg. Find the measure of the angle between the shorter leg and the hypotenuse.

____

AP Calculus Summer Assignment Part 2: Limits and Continuity

Name:____

Help Video: https://www.youtube.com/watch?v=7Q2HwTHcxA0



(a) $\lim_{x\to -4^-} f(x) =$

(b) $\lim_{x\to -4^+} f(x) =$

(c) $\lim_{x\to -4} f(x) =$

(d) $\lim_{x\to 1^-} f(x) =$

(e) $\lim_{x\to 1^+} f(x) =$

(f) $\lim_{x\to 1} f(x) =$

(g) $\lim_{x\to 4^-} f(x) =$

(h) $\lim_{x\to 4^+} f(x) =$

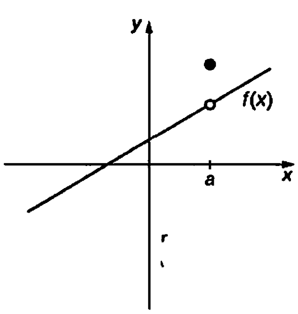
(i) $\lim_{x\to 4} f(x) =$

(j) $f(-4) =$

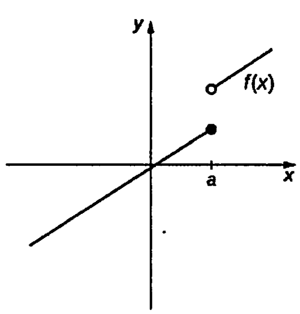
(k) $f(4) =$

(l) $f(f(0)) =$

Are the functions continuous? If not, label the name of their <u>discontinuity.</u>



(a)



(b)