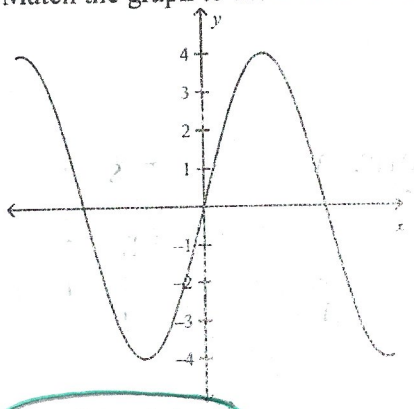
Name: Answer Key Class: _____ Date: _____ ID: A

Pre-Calculus Final Review

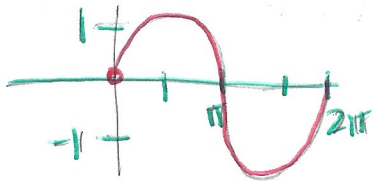
Multiple Choice
Identify the choice that best completes the statement or answers the question.

1. Match the graph to the correct function.



a. $f(x) = 4\sin(x)$
b. $f(x) = 4\cos(x)$
c. $f(x) = \sin(x + 4)$
d. $f(x) = \cos(x + 4)$

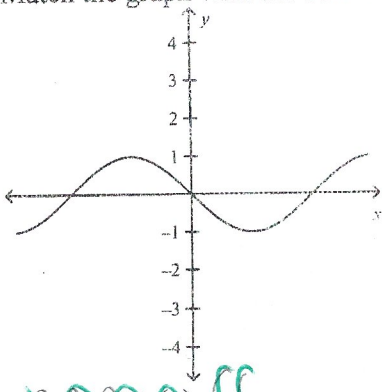
sinx



sinx starts at zero

not moving left/right

2. Match the graph with the correct function.



a. $y = -\tan(x)$
b. $y = -\cos(x)$
c. $y = -\sin(x)$
d. $y = -\sec(x)$

negative sign flips it over

starts at zero

3. Describe the shifts in the graph.

$f(x) = \cos(x + \frac{\pi}{3}) - 5$

down 5

left $\frac{\pi}{3}$

a. $\frac{\pi}{3}$ right, up 5
b. $\frac{\pi}{3}$ left, down 5
c. $\frac{\pi}{6}$ right, down 5
d. $\frac{\pi}{6}$ left, up 5

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4. Identify the amplitude, period and phase shift.
$f(x) = -5\sin 4(x+2)$

a. amp= 5
period= 2Π
phase shift= 4

b. amp= -5
period= Π
phase shift= -2

c. amp= 4
period= 2Π
phase shift= 2

d. amp= 5
period= $\frac{\Pi}{2}$
phase shift= -2

amp = 5
period = $\frac{2\pi}{k} = \frac{2\pi}{4} = \frac{\pi}{2}$

5. Which expression is equal to $\sin^2(x)$

a. $1+\cos^2(x)$

b. $1-\sec^2(x)$

c. $1-\cos^2(x)$

d. $1-\csc^2(x)$

$\sin^2x + \cos^2x = 1$
$-\cos^2x \quad -\cos^2x$
$\sin^2x = 1 - \cos^2x$

6. Determine the period of $y = 5\cot(3x)$

a. 5Π

b. $\frac{\Pi}{5}$

c. $\frac{2\Pi}{3}$

d. $\frac{\Pi}{3}$

period = $\frac{\pi}{k} = \frac{\pi}{3}$

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

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

b. $\frac{\sqrt{2}}{2}$

c. $\frac{1}{2}$

d. $-\frac{1}{2}$

$\frac{7\pi}{6} \Rightarrow \left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$

8. Find $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ where is the y-coordinate $= -\frac{\sqrt{3}}{2}$

a. $\frac{\Pi}{3}$

b. $\frac{4\Pi}{3}$ $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

c. $\frac{\Pi}{4}$

d. $\frac{\Pi}{6}$

9. Find $\tan^{-1}(-1)$ where is the $\frac{y}{x} = -1$

a. $\frac{\Pi}{2}$

b. $\frac{2\Pi}{3}$

c. $\frac{\Pi}{4}$

d. $\frac{3\Pi}{4}$ $\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right) = \frac{\frac{\sqrt{2}}{2}}{-\frac{\sqrt{2}}{2}} = -1$

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10. Find cos(75°) =
Use the addition/subtraction formulas

a. $\frac{\sqrt{6}-1}{2}$

b. $\frac{\sqrt{6}-\sqrt{2}}{4}$

c. $\frac{\sqrt{2}-1}{2}$

d. $\frac{\sqrt{6}-\sqrt{2}}{2}$

$\cos(45+30) = \cos 45^\circ \cos 30^\circ - \sin 45^\circ \sin 30^\circ$

$\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{3}}{2} - \frac{\sqrt{2}}{2}\cdot\frac{1}{2}$

$\frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} = \frac{\sqrt{6}-\sqrt{2}}{4}$

11. Given $\sin\theta = -\frac{3}{5}$ and $180 \le \theta \le 270$. Find $\tan\theta =$
Hint: Draw a triangle.

a. $\frac{2}{5}$

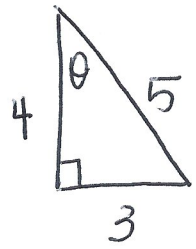
b. $\frac{3}{5}$

c. $\frac{3}{4}$

d. $\frac{5}{6}$

Q3

SOH CAH TOA



$\tan\theta = \frac{O}{A} = \frac{3}{4}$

12. Given $\sin\theta = -\frac{3}{5}$ and $180 \le \theta \le 270$. Find $\sin(2\theta) =$
Hint: Draw a triangle.

a. $\frac{9}{25}$

b. $\frac{3}{5}$

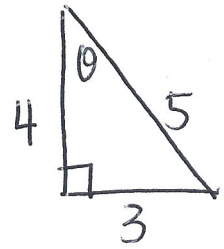
c. $\frac{1}{25}$

d. $\frac{24}{25}$

Q3

$\sin(2\theta) = 2\sin x \cos x$

$2\cdot\frac{-3}{5}\cdot\frac{-4}{5} = \frac{24}{25}$



$\cos x = \frac{A}{H} = \frac{-4}{5}$ Q3 cos x is negative

13. Solve the system
$x + 2y + z = 1$
$y + 2z = 5$
$x + y + 3z = 8$

a. (3, 1, 0)

b. (0, -1, 3)

c. (4, -1, 2)

d. (5, -6, 4)

$0 + -2 + 3 = 1$ ✓
$4 + 0 = 5$ ✓
$0 + -1 + 3 = 8$ ✗

plug in values

14. Is the system
$3x + 5y = 19$
$-(3x - y = 3)$

a. consistent

b. inconsistent

$3x + 5y = 19$
$-3x + y = -3$
$6y = 16$
$y = \frac{16}{6}$

normal solution

c. ~~infinitely many~~ solutions

d. no solution

$0 = 0$ True
$0 = \#$ False

15. Simplify and write results in a + bi form
$7 + \sqrt{-12}$

a. $7 - 2i\sqrt{3}$

b. $7 + 2i\sqrt{3}$

c. -5

d. $7 - 3i\sqrt{2}$

$7 + i\sqrt{12}$

$7 + i\sqrt{12}$

$7 + 2i\sqrt{3}$

12
4 3
2 2

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16. Find the dimension

$\begin{bmatrix} 2 & 5 & 1 \\ 0 & 6 & 3 \end{bmatrix}$

a. 3 X 2
b. 2 X 2
c. 4 X 2
d. 2 X 3

17. Find 2A + B =

Let $A = \begin{bmatrix} 2 & 3 & -1 \\ 5 & 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -3 & 4 \\ 1 & 5 & 7 \end{bmatrix}$

a. $\begin{bmatrix} 6 & 3 & 2 \\ 11 & 5 & 15 \end{bmatrix}$
b. $\begin{bmatrix} 5 & -1 & 3 \\ 8 & 4 & 2 \end{bmatrix}$
c. $\begin{bmatrix} 3 & 2 & 8 \\ -1 & 4 & 1 \end{bmatrix}$
d. $\begin{bmatrix} 10 & -8 & 4 \\ 6 & 5 & -3 \end{bmatrix}$

$2\begin{bmatrix} 2 & 3 & -1 \\ 5 & 0 & 4 \end{bmatrix} + \begin{bmatrix} 2 & -3 & 4 \\ 1 & 5 & 7 \end{bmatrix}$

$\begin{bmatrix} 4 & 6 & -2 \\ 10 & 0 & 8 \end{bmatrix}$ Add

$\begin{bmatrix} 6 & 3 & 2 \\ 11 & 5 & 15 \end{bmatrix}$

18. Find the determinant of

$\begin{bmatrix} 5 & 7 \\ 1 & 4 \end{bmatrix}$ 7, 20

$20 - 7 = 13$

a. -8
b. 13
c. 1
d. 26

19. Find $\begin{bmatrix} 1 & 3 \\ -4 & 0 \end{bmatrix} \begin{bmatrix} 2 & 5 & -2 \\ 3 & 0 & 4 \end{bmatrix}$

$\begin{bmatrix} 2+9 & & \end{bmatrix} = \begin{bmatrix} 11 & & \end{bmatrix}$

a. $\begin{bmatrix} 26 & 5 & -1 \\ -8 & 2 & 0 \end{bmatrix}$
b. $\begin{bmatrix} -11 & -5 & 2 \\ 6 & 0 & -1 \end{bmatrix}$
c. $\begin{bmatrix} 11 & 5 & 10 \\ -8 & -20 & 8 \end{bmatrix}$
d. does not exist

20. Find A^{-1} if $A = \begin{bmatrix} 3 & -2 \\ 4 & 1 \end{bmatrix}$ -8, 3

$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

$A^{-1} = \frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

a. $\begin{bmatrix} \frac{1}{11} & \frac{2}{11} \\ \frac{-4}{11} & \frac{3}{11} \end{bmatrix}$
b. $\begin{bmatrix} -3 & 2 \\ -5 & 6 \end{bmatrix}$
c. $\begin{bmatrix} \frac{2}{3} & \frac{-5}{6} \\ \frac{1}{2} & -1 \end{bmatrix}$
d. $\begin{bmatrix} \frac{2}{11} & \frac{1}{3} \\ \frac{5}{8} & -3 \end{bmatrix}$

$\frac{1}{3+8} = \frac{1}{11}\begin{bmatrix} 1 & 2 \\ -4 & 3 \end{bmatrix}$

21. Find the average rate of change of $f(x) = x^2 + 3x - 5$ $x = -2$ and $x = 5$

a. 1
b. -3
c. 5
d. 6

$f(5) = 5^2 + 3(5) - 5$
$25 + 15 - 5 = 35$

$f(-2) = (-2)^2 + 3(-2) - 5$
$4 - 6 - 5$

$\frac{f(b)-f(a)}{b-a} = \frac{f(5)-f(-2)}{5+2} = \frac{35+7}{7} = \frac{42}{7} = 6$

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$\frac{f(x+h)-f(x)}{h}$

22. Find the difference quotient of $f(x) = 5x - 2$

a. 2
b. 5
c. 3
d. 1

$\frac{5(x+h)-2-(5x-2)}{h}$

23. Convert to radians: $36° \times \frac{\pi}{180} = \frac{\pi}{5}$

a. $\frac{\pi}{5}$
b. $\frac{\pi}{3}$
c. $\frac{\pi}{2}$
d. $\frac{\pi}{4}$

$\frac{5x+5h-3-5x+1}{h} = \frac{5h}{h} = 5$

24. Convert to degrees: $\frac{5\pi}{12} \times \frac{180}{\pi} = 5 \cdot 15 = 75$

a. 102°
b. 50°
c. 36°
d. 75°

25. Convert the polar coordinates $\left(4, \frac{7\pi}{6}\right)$

a. $\left(2, \sqrt{3}\right)$
b. $\left(1, 2\sqrt{3}\right)$
c. $\left(-2\sqrt{3}, -2\right)$
d. $\left(\frac{2\sqrt{3}}{3}, 2\right)$

$x = r\cos\theta$ $y = r\sin\theta$

$x = 4 \cdot \cos\frac{7\pi}{6}$ $y = 4 \cdot \sin\frac{7\pi}{6}$

$4 \cdot \frac{-\sqrt{3}}{2}$ $y = 4 \cdot \frac{-1}{2}$

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

26. Convert the rectangular coordinates $\left(2\sqrt{3}, -2\right)$

a. $\left(4, \frac{11\pi}{6}\right)$
b. $\left(4, \frac{\pi}{3}\right)$
c. $\left(3, \frac{2\pi}{3}\right)$
d. $\left(\sqrt{3}, \frac{\pi}{4}\right)$

Q4

$r^2 = x^2 + y^2$

$r^2 = (2\sqrt{3})^2 + (-2)^2$

$r^2 = 2\sqrt{3} \cdot 2\sqrt{3} + 4$

$4 \cdot 3$

$r^2 = 12 + 4 = \sqrt{16} = 4$

27. Find the dot product $u \cdot v$ if $u = \langle 7, -1 \rangle$ and $v = \langle 2, 1 \rangle$.

a. 0
b. -2
c. 13
d. 15

$7 \cdot 2 + -1 \cdot 1$

$14 + -1 = 13$

28. Find the sum $u + v$ if $u = \langle 7, -1 \rangle$ and $v = \langle 6, 2 \rangle$

a. $\langle 13, 1 \rangle$
b. $\langle 1, -3 \rangle$
c. $\langle 13, 3 \rangle$
d. $\langle 5, 6 \rangle$

$\langle 7+6, -1+2 \rangle$

$\langle 13, 1 \rangle$

29. Find the sum of the arithmetic series

$\sum_{k=1}^{6} 6 - 3k$

a. -27
b. -40
c. 36
d. -21

$= n\left(\frac{a_1 + a_n}{2}\right) = 6\left(\frac{3 + -12}{2}\right) = 3 \cdot 6\left(\frac{-9}{2}\right) = -27$

$n = 6$

$a_1 = 6 - 3(1) = 6 - 3 = 3$

$a_n = a_6\ 6 - 3(6) = 6 - 18 = -12$

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30. Find the sum of the geometric series $\sum_{k=0}^{3}\left(\frac{1}{3}\right)^k$

a. $\frac{1}{3}$

b. $\frac{40}{27}$

c. $\frac{1}{27}$

d. $\frac{5}{3}$

31. Find the sum of the infinite series: $\sum_{n=1}^{\infty}\left(\frac{3}{5}\right)^n$

a. $\frac{5}{2}$

b. $\frac{3}{2}$

c. -3

d. 2

32. Find the exact value of $5^{\log_5 1000} - \log 1000 + 3^{\log_3 12}$

a. -2

b. 14

c. -3

d. 5

33. Write a single log for $3\log a + \log b - 4\log c$

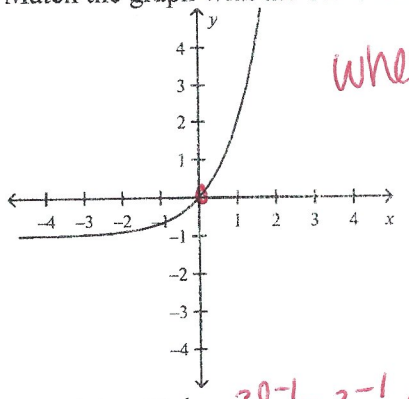
a. $\log(abc)$

b. $\log\left(\frac{ab}{c}\right)$

c. $\log\left(\frac{a^3 b}{c^4}\right)$

d. $\log\left(\frac{ab}{c}\right)^7$

34. Match the graph with the correct function.



a. $f(x) = 3^{x-1}$

b. $f(x) = -3^x$

c. $f(x) = 3^x - 1$

d. $f(x) = 3^{x+1}$

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35. According to the Fundamental Theorem of Algrebra, how many zeros does tge polynomial have in the complez number system.

$x^3 + 2x^2 + x + 5 = 0$

highest exponent

a. 3
b. 2
c. 1
d. 0

36. Find the center and vertices of the ellipse

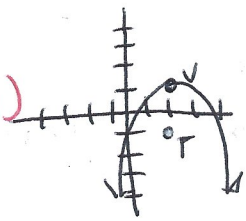
$\frac{x^2}{4} + \frac{y^2}{9} = 1$

center (0,0) a is the bigger #, so a = 3 and 3 is under the y^2

a. center (0,0)
vertices (0,±3)
b. center (2,3)
vertices (0,2) and (0,8)
c. center (0,0)
vertices (±3,0)
d. center (2,3)
vertices (4,0) and (0,9)

37. Fidn the equation of the parabola with vertex (2,1) and focus (2,-1).

a. $x = -\frac{1}{8}(x-2)^2 + 1$
b. $x = -\frac{1}{8}(x+2)^2 + 1$
c. $y = -\frac{1}{8}(x-2)^2 + 1$ h k V(2,1)
d. $y = -\frac{1}{8}(x+2)^2 + 1$ V(-2,1)



x^2

38. Identify the shape of the graph.

$5x^2 + 6y^2 + 7x + 8y + 11 = 0$

a. parabola
b. circle
c. ellipse
d. hyperbola

$\sin^2x + \cos^2x = 1$
$-\sin^2x \quad -\sin^2x$
$\cos^2x = 1 - \sin^2x$

39. Simplify and factor: $\tan^2x - \tan^2x \cdot \sin^2x$

a. $\cos^2x$
b. $\sin^2x$
c. $\tan^2x$
d. $1 - \tan^2x$

$\tan^2x(1-\sin^2x)$
$\frac{\sin^2x}{\cos^2x} \cdot (\cos^2x) = \sin^2x$

40. Multiply $(\cos x + \sin x)^2$

a. $\cos^2x + \sin^2x$
b. $1 + \sin 2x$
c. $\cos 2x$
d. $\tan^2x$

$(\cos x + \sin x)(\cos x + \sin x)$
$\cos^2x + \cos x \sin x + \cos x \sin x + \sin^2x$
$\cos^2x + \sin^2x + 2\cos x \sin x$ ← Formula
$1 + \sin 2x$

41. Simplify: $\sin 50° \cos 35° - \cos 50° \sin 35°$

a. $\sin 15°$
b. $\cos 15°$
c. $\sin 85°$
d. $\cos 85°$

$\sin(x-y)$
$\sin(50-35) = \sin(15°)$

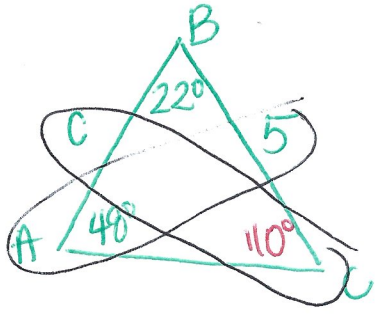
42. Find all solutions $[0, 2\pi]$ of $2\sin x - 1 = 0$

a. $\frac{\pi}{6}, \frac{5\pi}{6}$
b. $\frac{2\pi}{3}, \frac{4\pi}{3}$
c. $\frac{\pi}{3}, \frac{5\pi}{3}$
d. $\frac{\pi}{4}, \frac{3\pi}{4}$

$2\sin x - 1 = 0$
$+1 \quad +1$
$\frac{2}{2}\sin x = \frac{1}{2}$
$\sin x = \frac{1}{2}$ where is the y-coordinate $\frac{1}{2}$

43. Solve the triangle. Find c. If A=48°, B=22 and a=5.

a. 2.1
b. 6.3
c. 10.8
d. 13.1



$180 - (48+22) = 110$

$\frac{c}{\sin C} = \frac{a}{\sin A}$

$\frac{c}{\sin 110°} = \frac{5}{\sin 48°}$

$c \cdot \sin 48° = 5 \sin 110°$
$\frac{c \cdot \sin 48°}{\sin 48°} = \frac{5 \sin 110°}{\sin 48°}$
$c = 6.3$

44. Find $\sin 300°$ y-coordinate at $300° = -\frac{\sqrt{3}}{2}$

a. $\frac{1}{2}$

b. $-\frac{\sqrt{3}}{2}$

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

d. $-\frac{1}{2}$

45. Find $\sec\frac{\pi}{3}$ $\frac{1}{x}$ $\frac{\pi}{3}\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$ $\frac{1}{\frac{1}{2}} = 1 \cdot \frac{2}{1} = 2$

a. 2

b. -2

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

d. $\frac{1}{2}$

46. Find $\cos^{-1}\left(-\frac{1}{2}\right)$ where on the unit circle is the x-coordinate $-\frac{1}{2}$

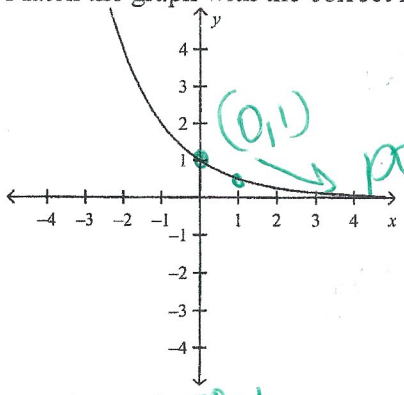
a. $\frac{5\pi}{6}$

b. ~~$\frac{\pi}{6}$~~

c. ~~$\frac{\pi}{4}$~~

d. $\frac{2\pi}{3}$ $\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$

47. Match the graph with the correct function.



a. $f(x) = 2^x$ $2^0 = 1$

b. $f(x) = \left(\frac{1}{2}\right)^x$ $\frac{1}{2}^0 = 1$ $\frac{1}{2}^1 = \frac{1}{2}$

c. ~~$f(x) = -2^x$~~ $-2^0 = -1$

d. ~~$f(x) = -\left(\frac{1}{2}\right)^x$~~ $-\frac{1}{2}^0 = -1$

48. Expand $\log\left(15x^3yz^5\right)$ $\log 15 + \log x^3 + \log y + \log z^5$

a. $\log 15x^3 + y + z^5$

b. $3\log 15x + \log y + 5\log z$

c. $\log 15 + 3\log x + \log y + 5\log z$

d. $\log 15x^3 - \log y + \log z^5$

$\log 15 + 3\log x + \log y + 5\log z$

49. Identify the shape of the graph.

$2x^2 + 3y + 7x + 9 = 0$

a. parabola

b. circle

c. ellipse

d. hyperbola

180−(20+31)=129

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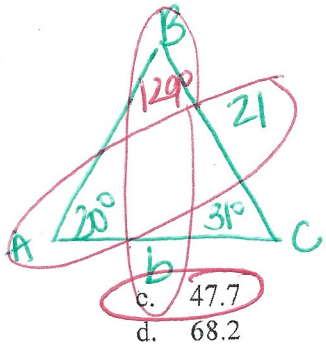
50. Solve the triangle. Find b.
Given A=20°, C=31° and a=21
a. 25.1
b. 35.3
c. 47.7
d. 68.2



$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{21}{\sin 20°} = \frac{b}{\sin 129°}$

$\frac{b\sin 20°}{\sin 20°} = \frac{21\sin 129°}{\sin 20°}$

$b = 47.7$

51. Given u=7i - j , v=2i + j and w=6i - 2j. Find $u \bullet (v+w)$
a. 57
b. 32
c. 46
d. 21

u<7,-1> v<2,1> w<6,-2>

v+w = <2+6, 1+-2> = <8,-1>

u•<8,-1>

<7,-1>•<8,-1>

7·8 + (-1)(-1)

56+1=57

52. Identify all vertical and horizontal asympotes and holes of the graph

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

a. Vertical: x=-3 and x=1
Horizontal: y=1
Hole: 3

b. Vertical: x=-3 and x=1
Horizontal: y=0
Hole: -3

c. Vertical: x=3 and x=-1
Horizontal: y=0
Hole: 3

d. Vertical: x=0
Horizontal: y=2
Hole: -3

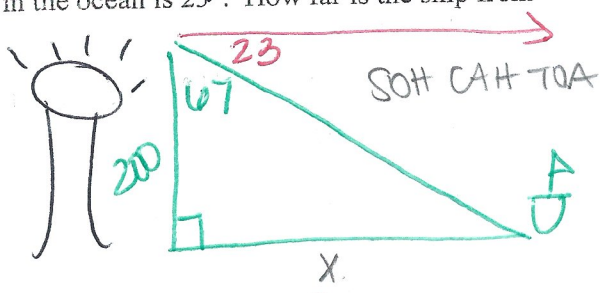
hole x+3=0
x=-3

vertical
top=0
2x=0
x=0

horizontal
$y = \frac{2x}{x} = 2$

53. From the top of a 200ft lighthouse, the angle of depression to a ship in the ocean is 23°. How far is the ship from the base of the lighthouse? Round to the nearest whole number.

a. 250
b. 471
c. 563
d. 1024



$\frac{\tan 67°}{1} = \frac{X}{200}$

$X = 200\tan 67°$

$X = 471$

54. Given log 7 = 0.845 and log 6 = 0.778. Find log 252.
a. 2.401
b. 25.8
c. 0.6574
d. 0.067

$\log 252 = \log 7 \cdot 6^2$

$= \log 7 + \log 6^2$

$= \log 7 + 2\log 6$

$0.845 + 2(0.778) = 2.401$

Pre-Calculus Final Review
Answer Section

MULTIPLE CHOICE

1.	ANS: A	PTS: 1
2.	ANS: C	PTS: 1
3.	ANS: B	PTS: 1
4.	ANS: D	PTS: 1
5.	ANS: C	PTS: 1
6.	ANS: D	PTS: 1
7.	ANS: D	PTS: 1
8.	ANS: B	PTS: 1
9.	ANS: D	PTS: 1
10.	ANS: B	PTS: 1
11.	ANS: C	PTS: 1
12.	ANS: D	PTS: 1
13.	ANS: B	PTS: 1
14.	ANS: A	PTS: 1
15.	ANS: B	PTS: 1
16.	ANS: D	PTS: 1
17.	ANS: A	PTS: 1
18.	ANS: B	PTS: 1
19.	ANS: C	PTS: 1
20.	ANS: A	PTS: 1
21.	ANS: D	PTS: 1
22.	ANS: B	PTS: 1
23.	ANS: A	PTS: 1
24.	ANS: D	PTS: 1
25.	ANS: C	PTS: 1
26.	ANS: A	PTS: 1
27.	ANS: C	PTS: 1
28.	ANS: A	PTS: 1
29.	ANS: A	PTS: 1
30.	ANS: B	PTS: 1
31.	ANS: B	PTS: 1
32.	ANS: B	PTS: 1
33.	ANS: C	PTS: 1
34.	ANS: C	PTS: 1
35.	ANS: A	PTS: 1
36.	ANS: A	PTS: 1
37.	ANS: C	PTS: 1
38.	ANS: C	PTS: 1
39.	ANS: B	PTS: 1
40.	ANS: B	PTS: 1
41.	ANS: A	PTS: 1
42.	ANS: A	PTS: 1
43.	ANS: B	PTS: 1
44.	ANS: B	PTS: 1
45.	ANS: A	PTS: 1
46.	ANS: D	PTS: 1
47.	ANS: B	PTS: 1
48.	ANS: C	PTS: 1
49.	ANS: A	PTS: 1
50.	ANS: C	PTS: 1
51.	ANS: A	PTS: 1
52.	ANS: D	PTS: 1
53.	ANS: B	PTS: 1
54.	ANS: A	PTS: 1

PRECALCULUS FORMULAS

Nth Term Formulas

$a_n = a_1 + (n-1)d$, arithmetic

$a_n = a_1 r^{n-1}$, geometric

Summation Formulas

Arithmetic: $S_n = \sum_{i=1}^{n} a_i = n\left(\frac{a_1 + a_n}{2}\right)$

Finite Geometric: $S_n = \sum_{i=1}^{n} a_i = a\left(\frac{1-r^n}{1-r}\right)$

Infinite Geometric: $S_n = \sum_{i=1}^{\infty} a_i = \frac{a_1}{1-r}$,

Addition/Subtraction Identities

$\sin(x+y) = \sin x \cos y + \cos x \sin y$

$\sin(x-y) = \sin x \cos y - \cos x \sin y$

$\cos(x+y) = \cos x \cos y - \sin x \sin y$

$\cos(x-y) = \cos x \cos y + \sin x \sin y$

$\tan(x+y) = \dfrac{\tan x + \tan y}{1 - \tan x \tan y}$

$\tan(x-y) = \dfrac{\tan x - \tan y}{1 + \tan x \tan y}$

Double Angle Identities

$\sin 2x = 2\sin x \cos x$

$\cos 2x = \cos^2 x - \sin^2 x$

$\tan 2x = \dfrac{2\tan x}{1 - \tan^2 x}$

Half Angle Identities

$\sin\dfrac{x}{2} = \pm\sqrt{\dfrac{1-\cos x}{2}}$

$\cos\dfrac{x}{2} = \pm\sqrt{\dfrac{1+\cos x}{2}}$

$\tan\dfrac{x}{2} = \dfrac{1-\cos x}{\sin x} = \dfrac{\sin x}{1+\cos x}$

Average Rate of Change

$\dfrac{f(b)-f(a)}{b-a}$

Difference Quotient

$\dfrac{f(x+h)-f(x)}{h}$

Polar to Rectangular and Rectangular to Polar

$x = r\cos\theta \quad y = r\sin\theta$

$r^2 = x^2 + y^2 \quad \tan\theta = \dfrac{y}{x}$

Standard Form Ellipse

$\dfrac{(x-h)^2}{a^2} + \dfrac{(y-k)^2}{b^2} = 1$

Standard Form-Hyperbola

$\dfrac{(x-h)^2}{a^2} - \dfrac{(y-k)^2}{b^2} = 1$

$\dfrac{(y-k)^2}{a^2} - \dfrac{(x-h)^2}{b^2} = 1$

Law of Cosines

$a^2 = b^2 + c^2 - 2bc\cos A$

$\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Law of Sines

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Area of a Triangle

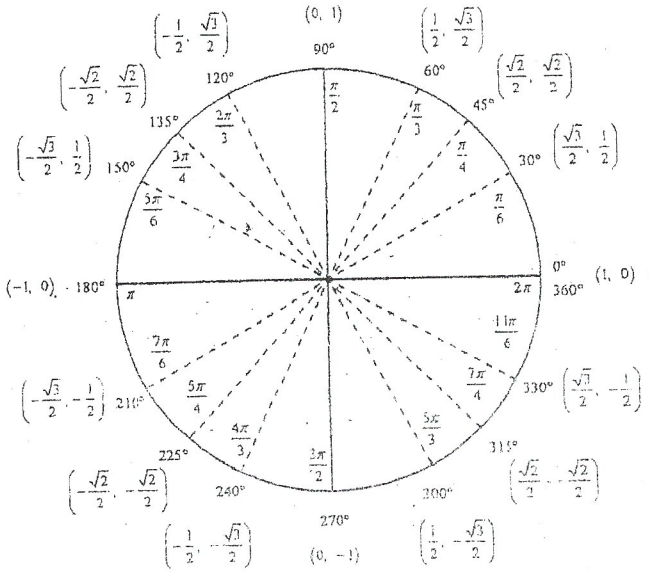
$Area = \dfrac{1}{2}bc\sin A$

Heron's Formula

$A = \sqrt{s(s-a)(s-b)(s-c)}$

$s = \dfrac{1}{2}(a+b+c)$

Unit Circle


(0, 1)
90°
$\frac{\pi}{2}$
$\left(-\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
$\left(\frac{1}{2}, \frac{\sqrt{3}}{2}\right)$
$\left(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
$\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$
120°
60°
$\frac{2\pi}{3}$
$\frac{\pi}{3}$
135°
45°
$\frac{3\pi}{4}$
$\frac{\pi}{4}$
$\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
150°
30°
$\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
$\frac{5\pi}{6}$
$\frac{\pi}{6}$
(−1, 0)
180°
π
0°
360°
2π
(1, 0)
$\frac{11\pi}{6}$
$\frac{7\pi}{6}$
$\frac{7\pi}{4}$
$\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
210°
$\frac{5\pi}{4}$
330°
$\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
$\frac{5\pi}{3}$
$\frac{4\pi}{3}$
315°
225°
$\frac{3\pi}{2}$
$\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$
$\left(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$
240°
300°
270°
$\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$
(0, −1)
$\left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$