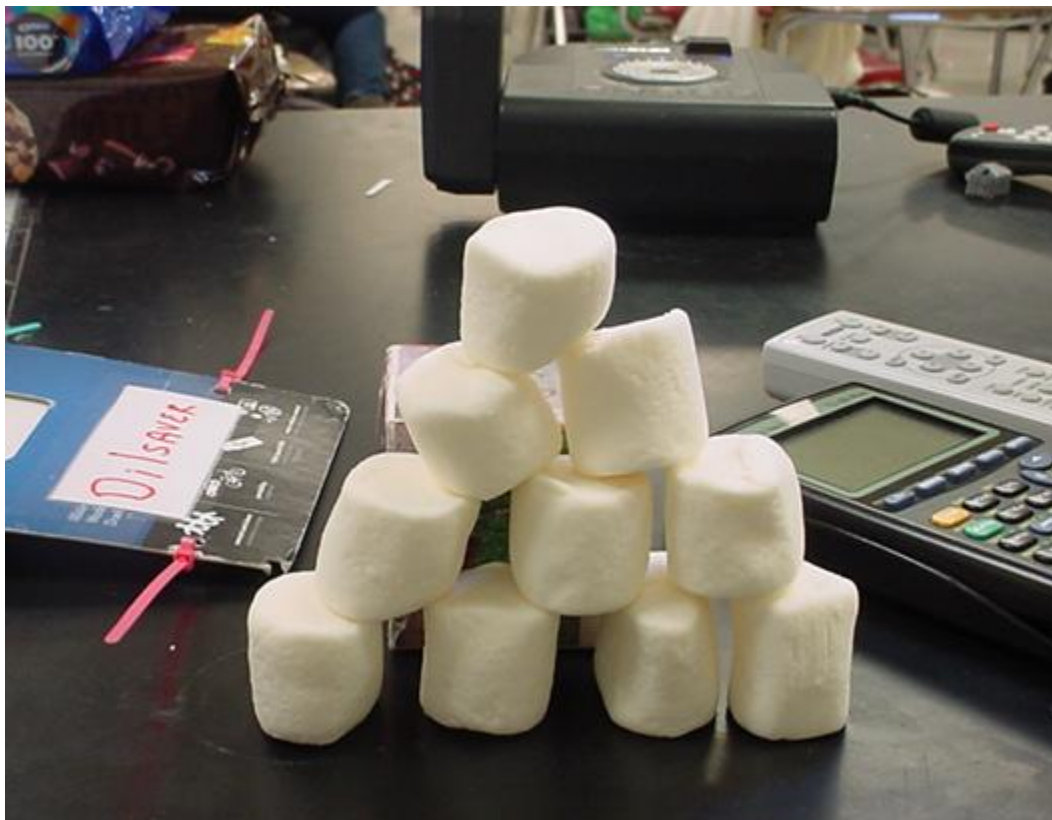


analysis 2.15.2013

Name: _____

Class: _____

Date: _____

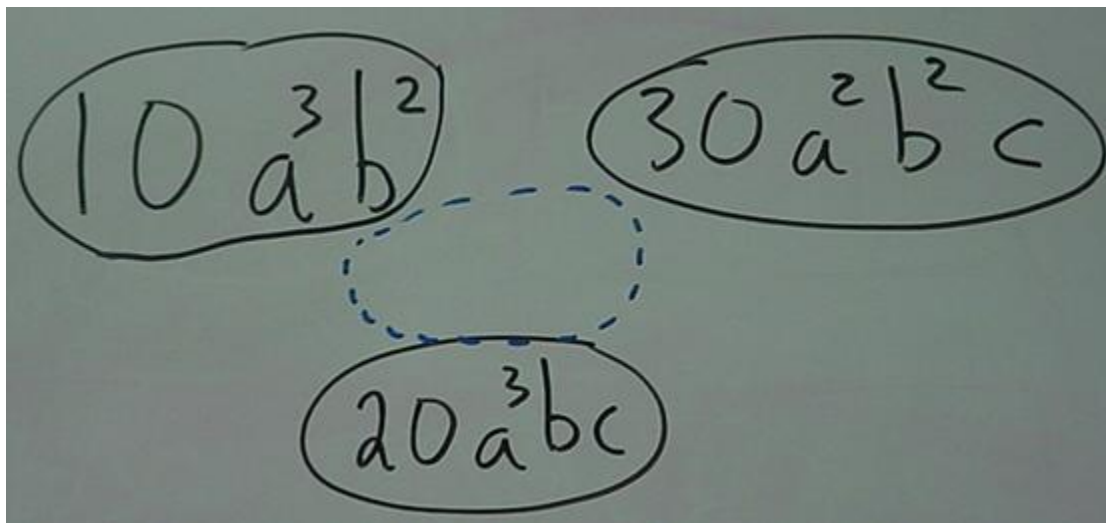


1. This time Brooke has 1127 coffee creamers and again she is making a triangular stack (only 1 layer thick, she has perfect balance). It's like the stack of marshmallows shown in the attached image. If H is the number of layers of coffee creamers (the attached image has four layers) and R is the number of coffee creamers left over, compute $H+R$.

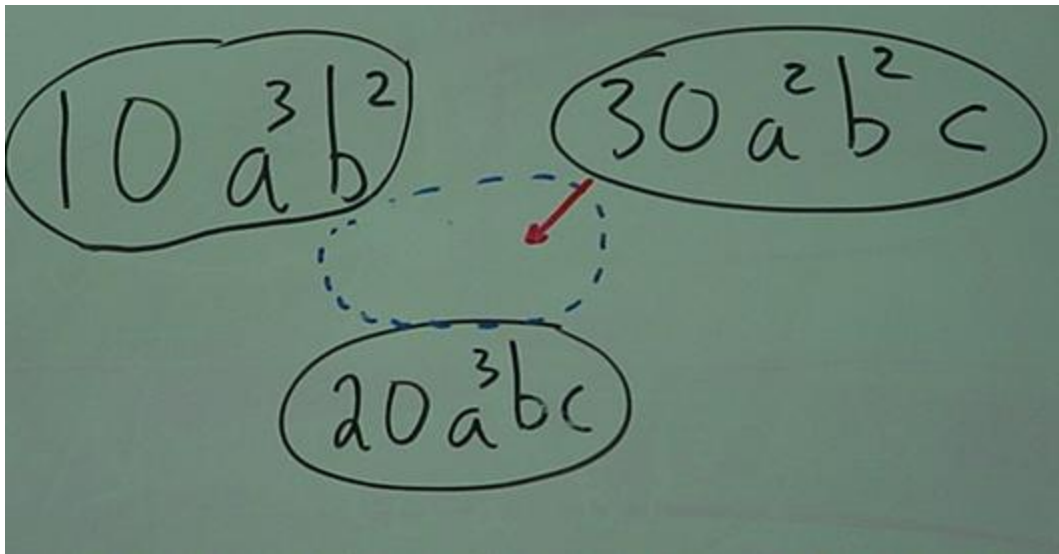
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2. Consider the attached image. Suppose that all the small cells that look like cells are actually square. How many squares are in the figure, counting as we usually do following along any existing lines in the figure.

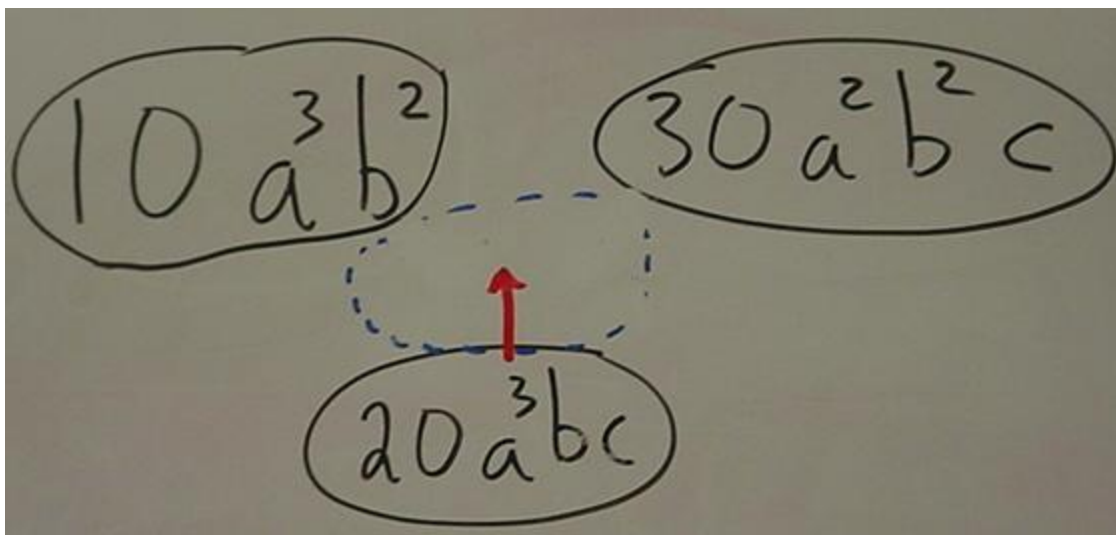
3. Sidney is thinking about various positive integers which are five digits long. She is thinking about numbers which begin with an even digit, which is followed by 4 odd digits. Sidney asks herself how many five digit numbers exist which begin with an even digit which is then followed by four non-repeating odd digits. So, how many such numbers exist.
4. How many five digit positive integers exist which start with an even digit and then have four odd digits. It is perfectly ok to repeat the odd digits.
5. Kyrsten Donielle was making up a four digit positive integer with some interesting properties. It started with an even digit, and then alternated odd digit, even digit, and ended with an odd digit. She noticed that 2781 would be one such number. How many different four digit numbers of this type could Kyrsten create?
6. How many four digit positive integers exist?
7. Samuel decides to be a mathematician after working with the thing-one-level-beyond-pascal's triangle. Upon pondering for a moment about how many marshmallows it would take to build level 17 of the thing-thats-one-level-beyond-pascal's-triangle, Samuel could instantly see how many were needed. How many marshmallows are needed to build level 17 (and ONLY level 17) of the structure we all built in class?



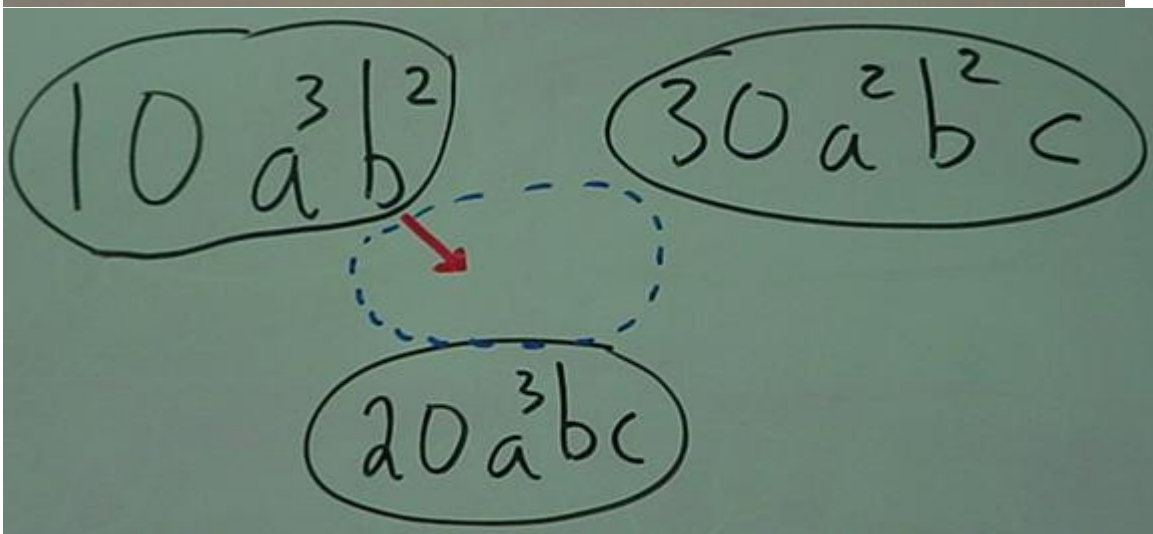
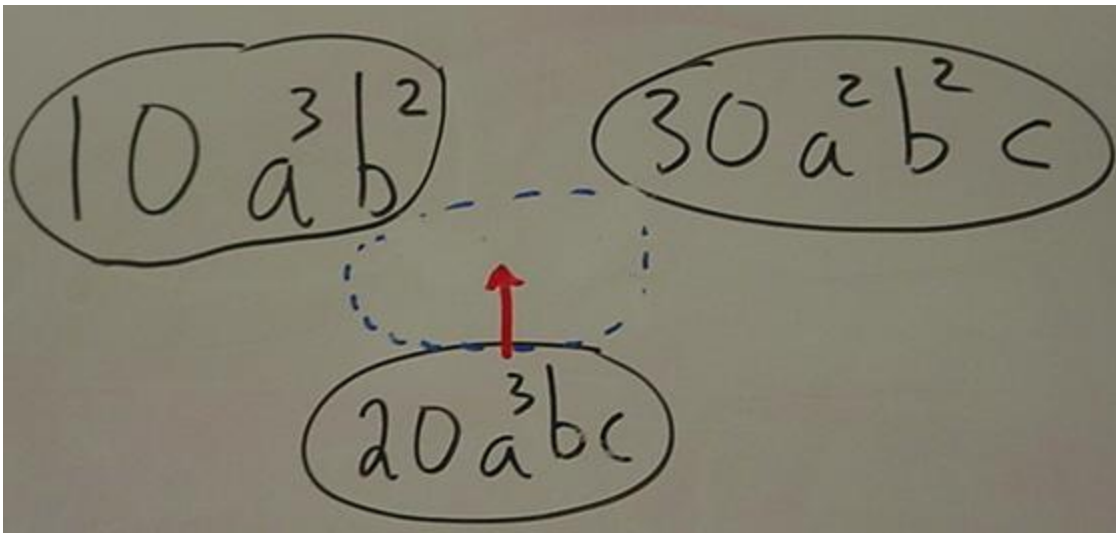
8. In the structure built from toothpicks and marshmallows that we built in class, if we were to build enough levels we would reach a level where three marshmallows would be labeled as shown in the attached image. What would be the name (it'll be a number type name) that would best name the level containing the three labeled marshmallows shown.
9. The blue dashed oval in the attached image represents a marshmallow on the next level below the level containing the three marshmallows with labels. What will be the coefficient of the term used to label this marshmallow?



10. The red arrow in the attached image represents a toothpick connecting the labeled marshmallow with the unlabeled marshmallow represented by the blue dashed oval in the next lower level. If we think of the pascal's pyramid as a three dimensional path problem then this toothpick represents a move in which direction?
- A. a
 - B. b
 - C. c



11. In the attached image the red arrow represents a toothpick connecting the labeled marshmallow shown with the blue-dashed unlabeled marshmallow in the next lower level. If we think of the pascal's pyramid as a three-dimensional path problem, the red arrow represents a move in which direction?
- A. a
 - B. b
 - C. c



12. The red arrow in the attached image represents a toothpick which connects the label marshmallow represented by a black outlined oval with a blue-dashed oval representing a marshmallow on the next lower level. If we think of pascal's pyramid as representing a three-dimensional path problem, this red arrow indicates a move in which direction?
- A. a
B. b
C. c

$$2(a + 2b - c)^3$$

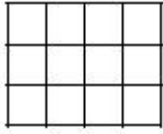
13. Consider the polynomial expansion in the attached image. How many terms will exist when this polynomial is expanded (multiplied out)?
14. How many two digit positive integers exist?
15. How many positive four digit numbers exist which have one or more 7's or 8's (it's ok to have both).

16. A drawer contains 20 white socks and 20 black socks. If the light is off and the socks feel exactly the same by touch, how many socks must you select in order to have at least 4 of the same color?
17. Not-that-many-years-from-now, Phillip W Dunger will (may) be appointed director of transportation for the state of Missouri. One aspect of his job will (may) be to plan license plate production for motor vehicles. Phillip notes that the 2010 census of Missouri showed 5,987,580 residents. Phillip estimates that each resident has an average of 4 licensed cars (yes, for everyone). Phil's plan is to use 4 non-repeating letters followed by some number of non-repeating digits. If director Dunger uses this method to produce license plates for Missouri, what is the least numbers of digits he can use and have enough different license numbers for all the cars in Missouri?
- A. 0
B. 1
C. 2
D. 3
E. 4
F. 5
G. 6
H. 7
I. 8
J. 9
18. A group of ten math enthusiasts form a Morning Math Munch Club, where they meet for breakfast and talk about exciting ideas in math. They elect a president, vice president, and chief-theorem-prover. If they follow the normal procedure that no one person may hold more than one office, how many different slates of officers may be selected.
19. Let's agree that a "word" can be any sequence of letters. If we rearrange the letters of PASCALWASARASCAL, how many different 16 letter "words" can we make?
- A. 1441440
B. $\frac{16!}{6! \cdot 3! \cdot 2! \cdot 2!}$
C. $\frac{16!}{6! \cdot 5! \cdot 3! \cdot 2!}$
D. 1,814,414,440
E. 1,800,101,441,440
F. None of the other choices are correct.

7²⁰¹⁴

20. Consider the rather large power of 7 shown in the attached image. It might take a couple minutes to multiply out this value, even for Hunter even using the ever-impressive TI-Inspire. What are the last two digits of this rather large number?

21. By how many distinct paths may one get from the upper left corner to the lower right corner of the grid shown at the right provided the only legal moves are “right” or “down”.



- A. 21
 B. 28
 C. 35
 D. 56
 E. 84

22.

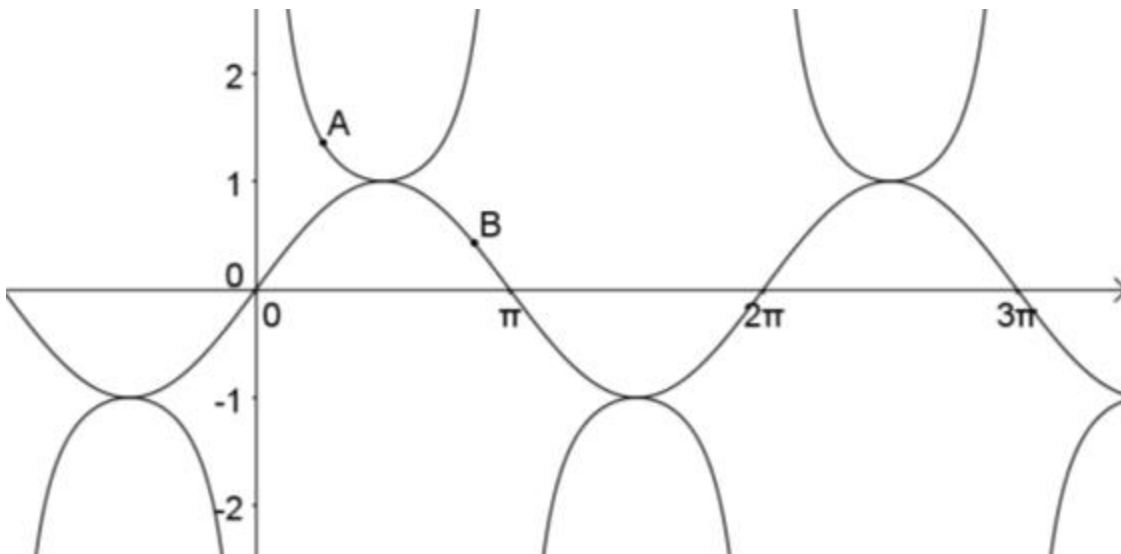
Evaluate $\sin(\arctan(\frac{3}{4}))$. You may suppose the angle is in standard position and terminates in first quadrant.

- A. $\frac{4}{3}$ B. $\frac{3}{5}$ C. $\frac{5}{4}$
 D. $\frac{5}{3}$ E. $\frac{4}{5}$

23.

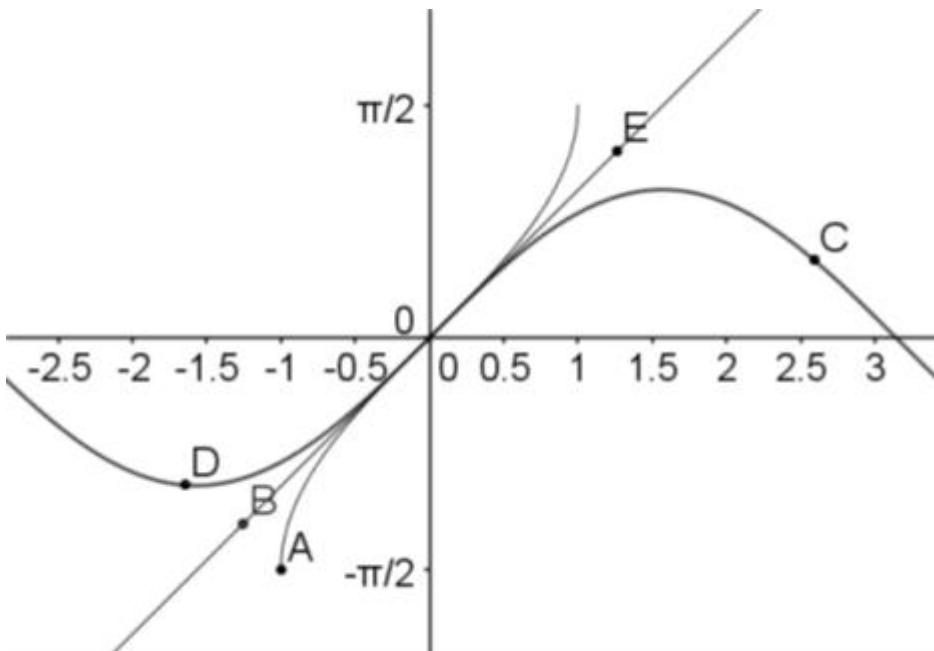
Convert 345° into radians.

- A. $62,100\pi$ B. 1.92 C. $\frac{23\pi}{12}$ D. $\frac{12\pi}{23}$



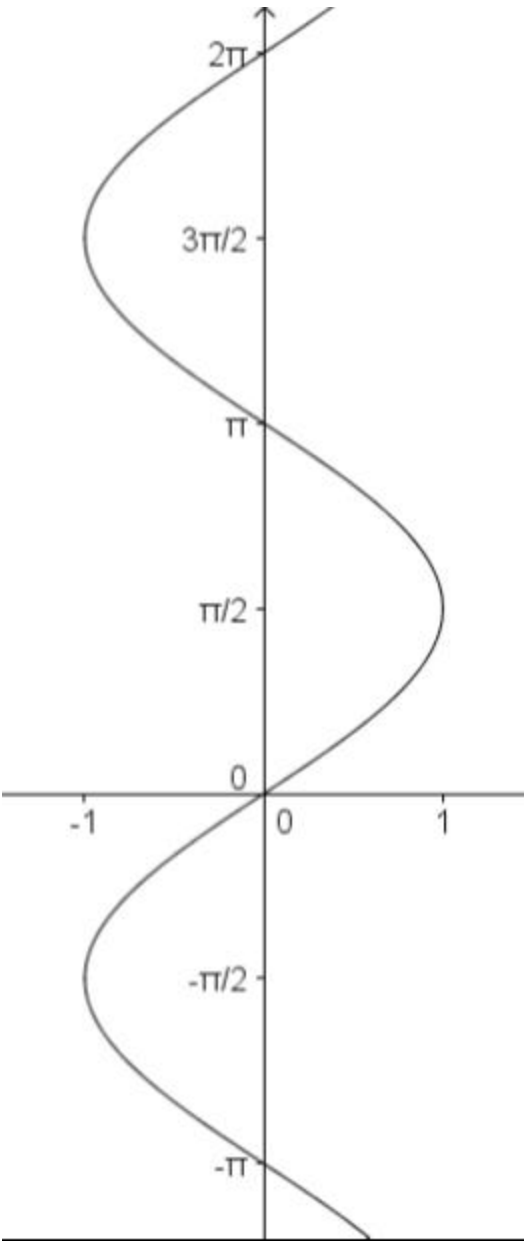
24. Locate the points A and B on the graphs plotted above. The statement which best describes the two functions containing points A and B is that they are?

- A. reciprocals
- B. inverse functions



25. Consider the family of graphs shown above. Which point is plotted on the graph of $y = \sin^{-1}(x)$?

- A. A
- B. B and E
- C. C
- D. D
- E. D and C



26.

The graph of the inverse relation for the sine function is shown above. This is the graph we drew on graph paper in pencil and folded along a certain reflection line and then traced to produce a graph of the inverse relation. To form a function we restricted the range of the inverse relation until it would pass the vertical line test. Which of the following gives the range of the function $y = \sin^{-1}(x)$.

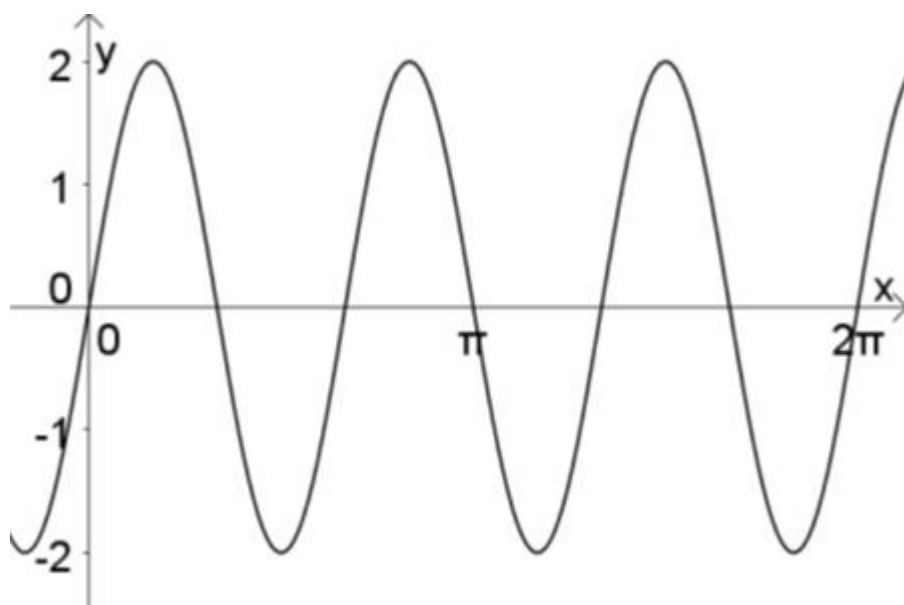
A. $-1 \leq y \leq 1$

B. $\frac{\pi}{2} \leq y \leq \frac{3\pi}{2}$

C. $0 \leq y \leq \pi$

D. $\frac{3\pi}{2} \leq y \leq \frac{5\pi}{2}$

E. $-\frac{\pi}{2} \leq y \leq \frac{\pi}{2}$



27.

Consider the graph shown at the right: The period of the graph shown is:

A. 2π

B. $\frac{\pi}{4}$

C. $\frac{2\pi}{3}$

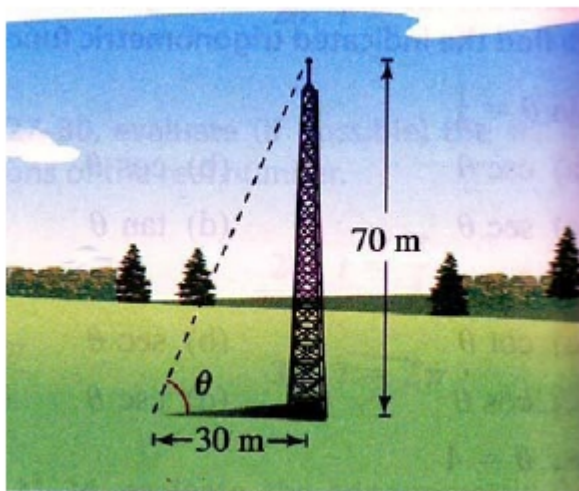
D. $\frac{\pi}{3}$

E. $\frac{\pi}{2}$

28. In a certain right angle triangle, $a = 5$, and $c = 10$. Find A . Note that the triangle's sides and angles are labeled in the customary way.

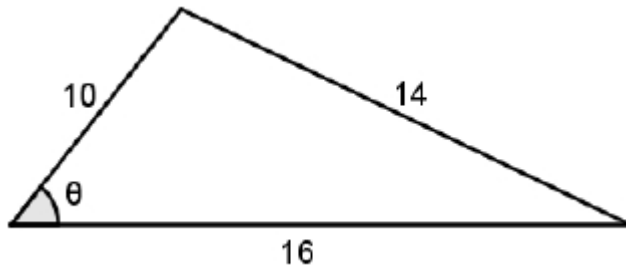
A. 30° B. 45° C. 60°
 D. 15° E. 75°

29. The height of a radio tower is 70 m. See the illustration at the right. The tower casts a shadow of length 30 m, as shown. Calculate θ the angle of elevation of the sun.



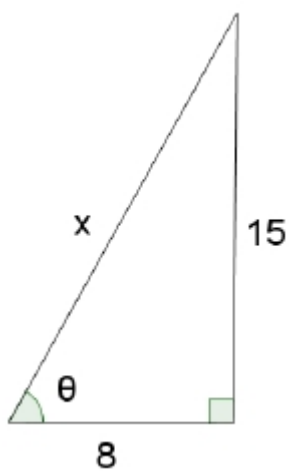
- A. 66.8°
 B. 49.4°
 C. 40.6°
 D. 30°
 E. 60°
30. Find the area of $\triangle ABC$ given $a=21$, $b=29$, and $C=102^\circ$.
- A. 182.4
 B. 297.8
 C. 300.8
 D. 304.5
 E. 595.7

31. In the triangle shown below:
compute θ



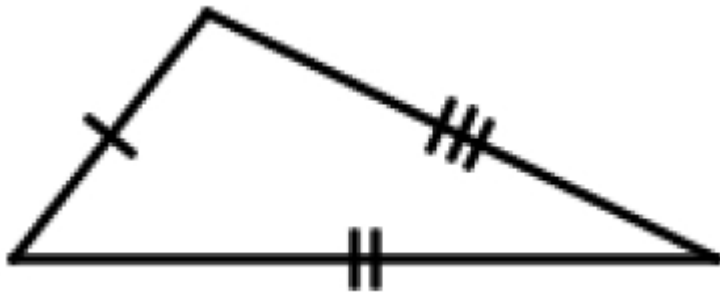
- A. 30
B. 60
C. 45
D. 57.2
E. 75
32. Given $\triangle ABC$ with $C = 96^\circ$, $c = 19$ units, and $b = 17$ units, find B .
- A. 21.1°
B. 35°
C. 62.9°
D. 74°
E. 54.3°

33.

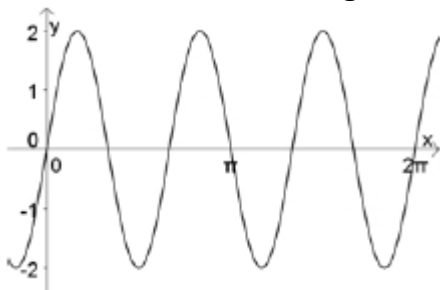
In the triangle shown at the right, find $\cos(\theta)$ 

- A. $\frac{15}{8}$
- B. $\frac{15}{17}$
- C. $\frac{8}{15}$
- D. $\frac{15}{17}$
- E. $\frac{8}{17}$

34. Use the diagram to tell which of the mathematical principles would be the best (or only) choice as a first step in solving the triangle shown. The parts marked are the angles or sides which are given. If the triangle can't be solved, then select choice D.



- A. law of cosines
 B. law of sines
 C. Pythagorean theorem
 D. The triangle can't be solved
35. Find the exact value of $\sin(u + v)$ if $\sin u = \frac{3}{4}$, $\cos v = -\frac{5}{13}$, and u and v are in Quadrant 2.
- A. Correct Response
 B. Incorrect Response
36. In the equation $y = A \sin B(x + C) + D$, what value of B would give the same period as the graph below:

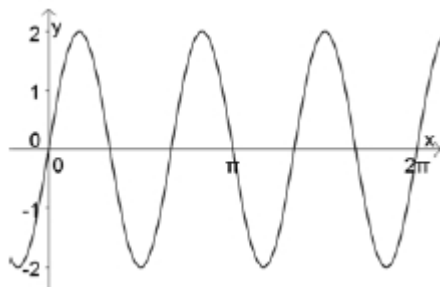


- A. 2
 B. 3
 C. 4
 D. 5
 E. 6

37.

Consider the graph shown at the right:

The period of the graph shown is:



A. 2π

B. $\frac{\pi}{4}$

C. $\frac{2\pi}{3}$

D. $\frac{\pi}{3}$

E. $\frac{\pi}{2}$