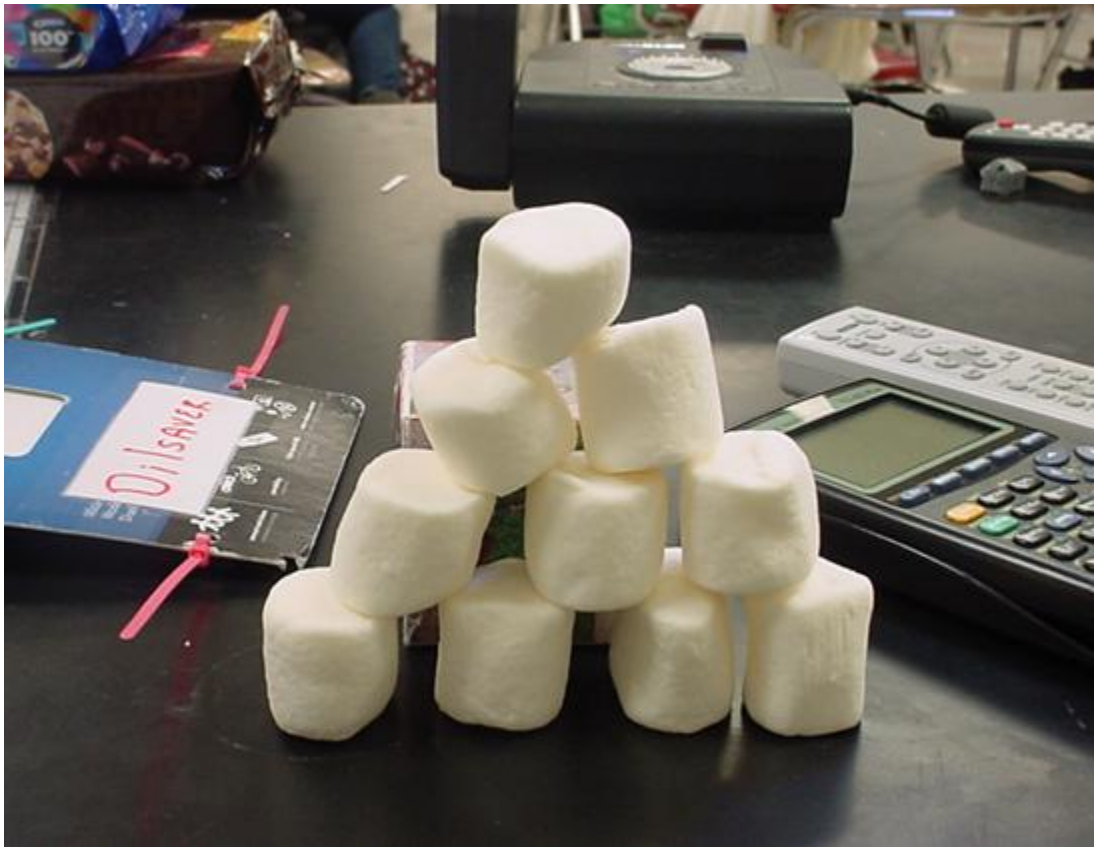
analysis 1.18.2013

Name: _____

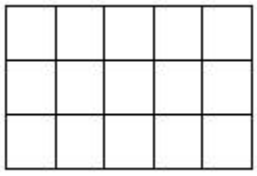
Class: _____

Date: _____

1. 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?

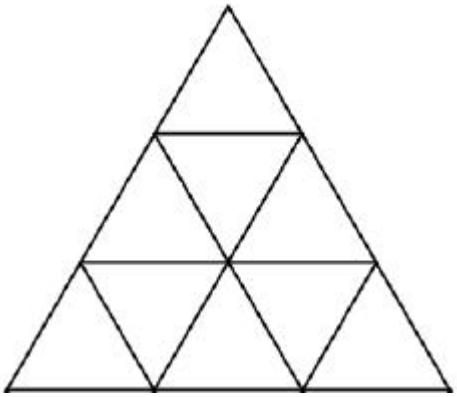


2. Young Brooke W was sitting eating breakfast at the Sand's cafe with MrW and MrD, building triangular structures out of coffee creamers as hinted at in the attached image. The image shows marshmallows instead of coffee creamers. Of course Brooke was energetic and kept flipping her coffee creamers one by one into Mr D's oatmeal. In self-defense, Mr D said to Brooke "If you had perfect balance so the stack wouldn't fall over and if you had a lot more coffee creamers, say 800, how tall would the stack be and how many creamers would be left over. If H is the number of layers of coffee creamers (the attached image has 4 layers) and R is the number of coffee creamers remaining, compute H + R.



3. Suppose that the cells that look like squares in the figure are actually squares. How many squares are in the figure, counting in the usual way that we do, following along any existing lines in the figure

A. 22
B. 23
C. 24
D. 25
E. 26
F. 27
G. None of these are correct



4. Consider the triangular grid shown in the attached image. Let's count the number of triangles of all different sizes formed by tracing along exising lines in the image.

5. Suppose Mr D's room contains 6 rows of student desks. Suppose further that the room is empty when 5 eager students walk in, each of whom insists on sitting in a front row seat. In how many different arrangements may these students take their front row seat?

A. 4!
B. 5!
C. 6!
D. 4
E. 5
F. 6
G. None of the other choices are correct.

6. 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

7. 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.

8. In class students constructed a structure that was one-level-beyond pascal's triangle with most groups using marshmallows and toothpicks. How many marshmallows did groups use to form level 3?

9. In class students built a structure one-level-beyond pascal's triangle. Most groups used toothpicks and marshmallows as material. Not many groups went to level 5, but if one were to build level 5 of this structure, how many marshmallows would be needed just to form level 5?

10. 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.

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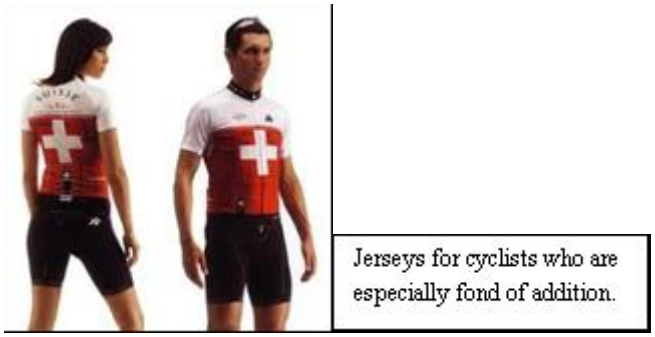
11. Consider the rather large power of 7 shown in the attached image. It might take a couple minutes to multiply out this value, even for Hunter even using the ever-impressive TI-Inspire. What are the last two digits of this rather large number?

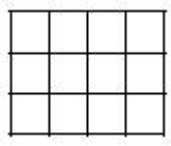
12. Nathan D is considering the digits 1, 3, 5, 7, 9. These are all the odd digits. He is thinking about making a 5 digit number, or maybe a 1 digit number using these 5 digits. How many different 1 digit or 5 digit numbers could Nathan make under these conditions?

13. Suppose a math teacher decides to relax by bicycling. Its summer and the temperature is higher than it is currently. The cyclist has a red spandex jersey, a yellow jersey, and a black wool jersey. (A jersey is another word for a shirt). The cyclist also has a pair of brown cycling shorts and a pair of dark blue cycling shorts. Lets suppose the cyclist is going to wear one jersey and one pair of shorts. In how many different ways can he use the clothes weve listed to dress for this ride?



A. 5
B. 3!2!
C. 5!
D. 6!
E. 6
F. 2^3
G. 3^2

14. 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

15. In the 30—60—90 triangle, which leg is across from the 60 degree angle?

A. shortest leg B. longest leg C. hypotenuse

16. Suppose θ is an angle in standard position whose terminal side passes through (-24,7). Give the value of $\tan(\theta)$.

A. $\frac{-25}{7}$ B. $\frac{7}{-24}$ C. $\frac{-24}{7}$

D. $\frac{-\sqrt{19}}{25}$ E. $\frac{24}{25}$

17. Suppose Mr D is talking about one of his favorite topics "angles as rotations" in Trigonometry, and he is rotating in front of the class as a visual example. Suppose MrD rotates through and angle of 4928 radians. Suppose further he could do this without getting dizzy and falling over. How many complete rotations did MrD do?

18. An angle θ in standard position whose measure is 4902° has its terminal side in which quadrant?

A. I B. II C. III D. IV

19. An angle θ in standard position whose measure is 1372° has its terminal side in which quadrant?

A. I B. II C. III D. IV

20. An angle θ in standard position whose measure is $4,235,000^\circ$ has its terminal side in which quadrant?

A. I B. II C. III D. IV

For the next set of questions, mark true or false

21. If two angles are both in standard position then they always share the same terminal side.

A. True
B. False

22. Since there are 360 of them in a circle clearly 1 degree is larger than 1 radian.

A. True
B. False

23. If two angles are both in standard position then they always share the same initial side.

A. True B. False

24. If two angles in standard position are coterminal then they share the same initial side.

A. True B. False

25. If an angle had a measure of three radians, then it's measure in degrees would be 150°.

A. True B. False

26. In our study of the various trigonometric functions, we have three functions whose names all start with the letters "co". These functions are cosine, cosecant, and cotangent. Which of the following mathematical terms is most clearly related to the reason each of these three names starts with "co"

A. cofunction B. coordinate C. complement D. coincident
E. consanguinity F. confusion

27. Suppose θ has a measure of $\frac{2\pi}{5}$, what is the measure of the complement of θ?

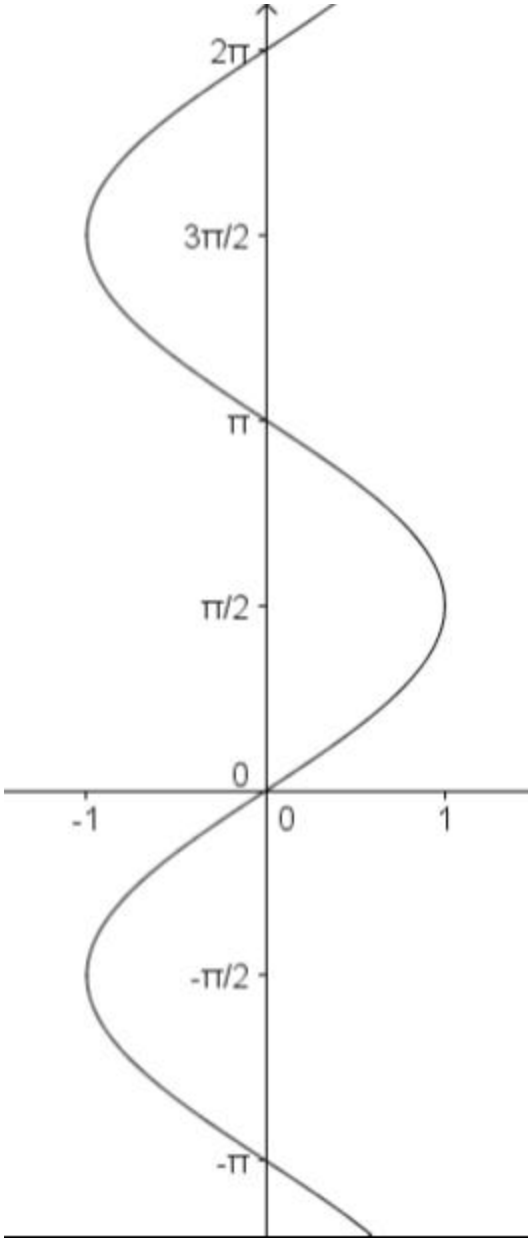
A. $\frac{\pi}{7}$ B. $\frac{\pi}{8}$ C. $\frac{\pi}{9}$
D. $\frac{\pi}{10}$ E. $\frac{\pi}{12}$

28. Find the complement of an angle whose measure is $\frac{2\pi}{7}$

A. $\frac{-5\pi}{7}$ B. $\frac{3\pi}{7}$ C. $\frac{9\pi}{7}$ D. $\frac{-4\pi}{7}$
E. $\frac{2\pi}{7}$ F. $\frac{23\pi}{7}$ G. $\frac{3\pi}{14}$

29. 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. $\frac{4}{5}$


2π
3π/2
π
π/2
0
-1
0
1
-π/2
-π

30. 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. $-1 \le y \le 1$

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

C. $0 \le y \le \pi$

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

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