1. **B.** Since the question is asking for the largest proportion of peasants, we must find the reciprocal of the ratio to find peasants to knights, and then find the largest value. The largest peasants to knights ratio is 5:2, which means the 2:5 path has the largest proportion of peasants, B.
2. **C.** Natural numbers start from 1 and go on into infinity so we can ignore 0 and all the negative integers in the given interval. However, only the numbers from 1 to 3 are added because 4 is not included which is indicated by the parentheses. 1 + 2 + 3 = 6, C.
3. **C.** Distinct permutations of words are found by the number of letters factorial divided by any repeated letters factorial. So in the word “purple”’s case, we solve by doing because the letter “p” appears twice. 6! is equal to 720 and 2! is equal to 2. = 360, C.
4. **E.** The graph passes through quadrants I and II, E.
5. **B.** The function must be solved from the inside to the outside. f(9) = 2(9) + 2 = 20,g(20) = 20 - 1 = 19, f(19) = 2(19) + 2 = 40, g(40) = 40 - 1 = 39, g(39) = 39 - 1 = 38, B.
6. **D.** 2 is the smallest prime number and there are 20 faces on an icosahedron. Since John is also in the line, we need to add one more person, which would make a total of 23 people, D.
7. **A.** 50% of 800 of 400, 18% of 400 is 72, and 25% of 72 is 18, A.
8. **D.** The values of the powers of i repeats in a cycle, such that:

Since 1000 is divisible by four, would just be the last number in the cycle: 1, D.

1. **D.** The formula for the area of a circle is . Answers are not given with pi so you can multiply 36 and 16 with a rough estimate of 3.14. The area of the circles are approximately 36 \* 3.14 = 113.04 and 16 \* 3.14 = 50.24. To find the space between the two circles, you must subtract the two areas. 113.04 - 50.24 = 62.8, D
2. **C.** To solve, you want to separate the repeating and non-repeating portions of the fraction as they yield different denominators. In this case, we can separate the fraction into 0.7 + 0.0. For 2-digit repeating decimals, you can use the part that repeats as a numerator and 99 as the denominator. This gets , however, it has a 0 in front of it so we can divide the answer by 10, getting . Adding 0.7 or to that, we get an answer of , C.
3. **C.** First, we need to simplify the numerator [13(110 – 5) + 211]. The numerator is equal to 1576. 1576 divided by 8 is equal to 197. 197 - 13 + 6 = 190, C.
4. **B.** To find the common factors of the three numbers, you must find the prime factorization of each number. The prime factorization of 13110 is . The prime factorization of 5211 is . The prime factorization of 8136 is . The only common factors are 1 and 3, which add up to 4, B.
5. **A.** Brighten and Filippo travel a collective 50 miles per hour meaning that they will meet after a total of 4 hours, traveling the full 200 miles. The fly travels at 16 miles per hour and with a total of 4 hours, the fly will travel 16 \* 4 = 64 miles, A.
6. **B.** Yangyang can only get 10 total points if he gets 2 points on his last shot. Using the formula for the area of a circle, , the total area of the target is . The area of the ring that scores 2 points can be calculated by subtracting the area of the circle with a 2-inch radius by the center, a circle with a 1-inch radius. – . We then put the area of the ring over the total target area and get a probability of , B.
7. **C.** To find the halfway mark between two coordinate points, you need to find the average between the x and y of the two. and . Simplifying both x and y, we get x = -3 and y = 3.5, (-3, 3.5), C.
8. **B.** Let a, b, and c denote the number of pigs, cows, and chickens on the farm respectively. You are given that *c = 2(a + b), a = 3b, and 128 = 2c + 4(a + b).* Substituting the second equation into the first gives *c = 2(3b + b) = 8b,* and substituting this along with the second equation into the third equation gives *128 = 2(8b) + 4(3 b + b) = 32b.* Dividing both sides by 32 gives that b is equal to 4, so the number of pigs is equal to *3b = 12,* B.
9. **D.** To find the percentage divide the amount by the total: 6/24 = 0.25. That written as a percentage is 25%.
10. **A.** There are 3 vowels in “David Brown” and 4 vowels in “David White”. The least common multiple between 3 and 4 is 12.
11. **A.** To find the volume of a prism, we can use the formula of volume, (V is volume, B is the trapezoidal base, and H is height of the prism). To find the base, we can use the formula for a trapezoid which is (where A is the area, a is one trapezoidal base, b is one trapezoidal base, and h being the height). Because the trapezoid is turned on its side, the two bases are the two parallel lines, and the height of the trapezoid is the 4. Plugging in we get that the trapezoidal base area is equal to = . This is the “B” part of the earlier formula. To find the volume, you just have to multiply that by the height of the prism, which is 2. This gets a grand total of , A.
12. **D.** There are 60\*2.5 = 150 minutes in 2.5 hours. A moment is 1.5 minutes and 150/1.5 = 100 moments in 2.5 hours, D.
13. **E.** To find out the amount of total turns Nelson and Nima do in 5 minutes, we can first find out how many they can do in one minute. Nelson does 19 turns in 2 minutes meaning that

he does 19/2 turns in one minute. Nima does 25 turns in 3 minutes meaning that he does 25/3 turns in one minute. Multiplying by 5 for 5 minutes, we get that Nelson does 95/2 spins total and Nima does 125/3 spins. Because the problem asks for the complete number of spins total, we can find the solution minus the remainder, so we get that nelson does 47 completed spins and Nima does 41 completed spins. They cannot work together on spinning individually, so we get 41+47 = 88 compete, total spins, E.

1. **D.** The surface area of the top is 25π square feet, so the radius is 5 feet and thus, the diameter is 10 feet. The answers are in inches, so 10\*12=120 in, D.
2. ***B.*** Since Linsey isn’t sitting next to David or Khawla, she also isn’t sitting next to Katharine because she is in between Linda and Khawla. Therefore, Linsey must be sitting next to Ben and Linda. This means that Ben is sitting next to Linsey and David, and David is not an answer choice.
3. **C.** Jonathan does 3, 6, 12, then 24 sets. After the 4th day he has done 3+6+12+24=45 total sets of 12. Multiplying 12 by 45, we get 540 total pushups.
4. **B.** We can start with evaluating the numerator. Using PEMDAS we get that . The denominator is easier. We know that 8/2 is division, so it goes first; 6+4=10. If the numerator is -37 and the denominator is 10, we get an answer of -37/10, B
5. **E.** Exponents with the same base do not add up, so the expression cannot be simplified.
6. **D.** 2021! Can be written as (2021)(2020)(2019)(2018)…(3)(2)(1) and 2020! Can be written as (2020)(2019)(2018)…(3)(2)(1). We can immediately realize that dividing 2021! by 2020! will cancel out all the numbers except for 2021, D.
7. **B.** We can start with the numerator of the second equation, following the order of operations, multiplication first then addition, we get 13-3\*2=13-6=7. To compare the two fractions’ numerators, we want the denominators to match up. Multiplying both sides of the second equation by 3, we get 21/12, so s=21. James has 21 pairs of shoes. Each pair has two shoes, so James will end up with 42 shoes total, B.
8. **D.** Cyrus builds one fence in 5 days, meaning that he builds of the entire fence in a day. This leaves of the entire fence left to be built by them both. To find this out, we need to find out how many fences they can build together in a certain amount of time. Cyrus can build fences in a day and Wesley can build fences in a day. Working together they can build + = fences in a day. Dividing the amount of fence they need to build by the number of days it takes to build a fence, you get or days to finish together. Adding on the one day at the beginning, this leaves the total time at total days, D.
9. **A.** A sphere’s volume is , meaning that the radius is cubed. If the statue’s head is 3 times that of Walter, it means that Walter’s head’s radius takes up 1/3 of the statue’s radius. Cubing that, it gets 1/27, A.