

1. Welcome to the savanna! In order to enter, you must solve this simple problem. What is $9 + 10$?

We have $9 + 10 = \boxed{C, 19}$.

2. Now that we're in the savanna, it's time to take a wildlife tour on the Algebraic Explorer. To trick the visitors into paying him more, Nelson makes customers choose the equation whose value they will pay as a tour fee. He gives each visitor the same three choices:

I. $2023 - 202 + 32 - 23 + 203 - 2020$

II. $23(73 - 9 \cdot 7) \div 5$

III. $(53 - 38) \div 25 + (2023 \div 289)$

Which of the following is the cheapest tour fee (assume all equations are expressed in dollars)?

I. $2023 - 202 + 32 - 23 + 203 - 2020 = 13$

II. $23(73 - 9 \cdot 7) \div 5 = 46$

III. $(53 - 38) \div 25 + (2023 \div 289) = 7.6$

Since $7.6 < 13 < 46$, the answer is $\boxed{C, \text{III}}$.

3. Using the same tour fee choices from the last question, which of the choices would be the most expensive?

Since $7.6 < 13 < 46$, the answer is $\boxed{B, \text{II}}$.

4. Nelson finally sold out all the seats on the Algebraic Explorer and wants to see how well he tricked his customers. He sold 8 tickets from choice I, 11 tickets from choice II, and 5 tickets from choice III. How much did Nelson make from this tour?

$8 \cdot 13 + 11 \cdot 46 + 5 \cdot 7.6 = 648$. Thus, the answer is $\boxed{A, \$648}$.

5. As you are finding your seat on the Algebraic Explorer, you notice the walls are covered by multiple drawings of the number zero. To which of the following set(s) does zero belong to?

I. Whole numbers

II. Natural numbers

III. Prime numbers

IV. Integers

By definition, 0 is a whole number and an integer. Thus, the answer is $\boxed{E, \text{I and IV only}}$.

6. The wildlife tour is about to start! The time is currently 11:39 AM and the wildlife tour is set to start at 11:45 AM. Unfortunately, the Algebraic Explorer's engine and air conditioning just broke down and the tour can't start! The only mechanic near the savanna is Roger, who is 4 miles away from the Algebraic Explorer. Roger runs at a constant pace of 12 miles per hour to get to the algebraic explorer by the shortest route. If it takes Roger 19 minutes to fix the engine and 28 minutes to fix the air conditioning, how many minutes late is the start of the wildlife tour? Assume the tour starts the moment that Roger finishes fixing the Algebraic Explorer.

It takes Roger $4 \div 12$ hours = 20 minutes to reach the Algebraic Explorer. The total fix time including travel is $20 + 19 + 28 = 67$ minutes, and since Roger started traveling 6 minutes before the planned tour time, the tour is $67 - 6 = \boxed{D, 61}$ minutes late.

7. While waiting for the air conditioning to get fixed, the passengers in the Algebraic Explorer start complaining about the heat inside. Hadriel and Shawn who work as tour guides show the passengers that there is a completely filled water bottle underneath each of the 24 seats on the Algebraic Explorer. Each water bottle is shaped as a cylinder with radius 2 inches and height 1 foot. What is the total volume of all the water in these bottles?

Each bottle has volume $2^2 \cdot 12\pi = 48\pi \text{ in}^3$, so the total volume of all 24 water bottles is $48\pi \cdot 24 = \boxed{C, 1152\pi \text{ in}^3}$.

8. Yiyan looks out the window and sees two giraffes! If one giraffe is three times as tall as half the height of the other giraffe, and the taller giraffe has a height of 18 feet, what is the height of the other giraffe in feet?

From the information given, we can tell that one giraffe has a height $\frac{3}{2}$ times that of the other. This taller giraffe has a height of 18 feet and the other giraffe has a height $\frac{2}{3}$ that of the taller one. $\frac{2}{3} \times 18 = \boxed{C, 12}$.

9. On the other side of the Algebraic Explorer, a herd of five elephants walks by. A sixth elephant then joins them. If the first five elephants have an average trunk length of 6.2 feet, and the sixth elephant has a trunk of length 6.8 feet, what is the average trunk length for all six elephants in feet?

$6.2 \times 5 = 31$ is the sum of the trunk lengths for the first five elephants. By adding 6.8 and dividing by 6, we can find the new average of $\boxed{A, 6.3}$.

10. The Algebraic Explorer is finally starting the tour. If it is moving on the path $y = 11x + 43$ and there is a continuous river on $y = 17x - 35$, what is the x -value where the path intersects the river?

The desired x -value satisfies $11x + 43 = 17x - 35$, which rearranges to $6x = 78$. Dividing out by 6 gives $x = \boxed{D, 13}$.

11. The AC broke down again and Aaron and Shaoyang can't stand it anymore! Enraged, they jump out of the van and run away from the savanna towards a troop of gorillas. The silverback will let them join the troop if they collect 616 bananas. Aaron can collect 4 bananas every 1.5 minutes, and Shaoyang can collect 15 bananas every 4 minutes. If they work together, how many minutes will it take them to collect the 616 bananas?

Aaron picks 4 bananas every 1.5 minutes which is 32 bananas every 12 minutes. Shaoyang picks 15 bananas every 4 minutes which is 45 bananas every 12 minutes. Together they pick 77 bananas every 12 minutes. $616 \div 77 = 8$ and $8 \times 12 = \boxed{C, 96}$.

12. After collecting the bananas, Aaron, Shaoyang, and the gorillas stand in a circle around the pile of bananas to perform a ritual that will turn Aaron and Shaoyang into gorillas. If there are five gorillas and Aaron and Shaoyang must stand next to each other, how many distinct ways are there to arrange these seven individuals in a circle? (Assume that all gorillas are distinguishable from one another.)

Since Aaron and Shaoyang must stand next to each other, they can count as one individual. To find the arrangements in a circle we use $A = (n - 1)!$ where n is the number of individuals. 5 gorillas + 1 Aaron and Shaoyang = 6 individuals. $(6 - 1)! = 5! = 120$. This is then multiplied by 2 since Aaron and Shaoyang can swap places. Thus, the answer is $120 \times 2 = \boxed{B, 240}$.

13. Now that Aaron and Shaoyang are gone, there are only 22 filled seats. It just happens that "22" is Minjun's favorite Taylor Swift song. If Minjun listens to "22" 22 times and "22" is 3 minutes and 51 seconds long, how long does Minjun listen to "22"?

3 minutes and 51 seconds is 9 seconds less than 4 minutes, so 22 times this is 198 seconds less than 88 minutes. 198 seconds is 3 minutes and 18 seconds, so the desired time is $\boxed{D, 84 \text{ mins}, 42 \text{ secs}}$.

14. James and Arib were exploring the Serengeti when a pack of hyenas emerged in the distance and started chasing them. If the Serengeti can be mapped as a Cartesian plane, with James and Arib's trajectory as the line $y = -0.5x + 2$ and the hyenas' trajectory as $y = -x + 7$, where will the lines intersect, with the hyenas catching up to James and Arib?

We need to solve $-0.5x + 2 = -x + 7$, which rearranges to $0.5x = 5$. Then multiplying by 2 gives $x = 10$, and plugging this back in gives $y = -10 + 7 = -3$, and the answer is $\boxed{B, (10, -3)}$.

15. James and Arib were able to escape from the hyenas! To celebrate surviving their encounter, they decided to crack open their Prealgebra workbooks and isolate some variables. If you have 2 equations $3x + 6y = 24$ and $4x + 8y = 15$, what is x ?

Dividing the first equation by 3 gives $x + 2y = 8$ and dividing the second equation by 4 gives $x + 2y = \frac{15}{4}$. Since these are not equal, there is no solution, and the answer is $\boxed{E, \text{no solution}}$.

16. Heewon and Yimo love swimming and decide to hold a relay race against two Hippos in the savanna's river. The race covers 1 mile and each team will tag in their second member after covering half a mile. Heewon, who is starting the race can swim at 440 feet/minute and the Hippo starting the race for his team can swim at 370 feet/minute. How far ahead (in feet) of the Hippo will Heewon be when he reaches half a mile? Note that here are 5280 feet in a mile.

Every 440 feet Heewon swims, the Hippo will be $440 - 370 = 70$ feet behind. Then after half a mile, which is $\frac{1}{2} \cdot 5280 = 2640$ feet, the Heewon will be $\frac{70}{440} \cdot 2640 = \boxed{C, 420}$ feet ahead of the Hippo.

17. Using the same information from the previous question, if Yimo swims at 8 miles per hour and the second hippo swims at 6 miles per hour, which team wins the race? Yimo and Heewon are representing Team Chiles while the Hippos represent Team Savanna.

Since both Heewon and Yimo are faster than their respective hippos, their team will win, and the answer is $\boxed{B, \text{Team Chiles}}$.

18. While looking at the gazelles and leptoptilos, you begin to wonder. If you were to randomly select a letter from each of the words "gazelles" and "leptoptilos," what is the probably you'd get a vowel both times?

The first word has 8 letters, 3 of which are vowels. The second word has 11 letters, 4 of which are vowels. Then the answer is $\frac{3}{8} \cdot \frac{4}{11} = \boxed{B, 3/22}$.

19. Dale holds an ostrich race. If two ostriches are competing to complete 40 laps on a $\frac{1}{4}$ mile long track, and the first ostrich finishes in 10 minutes with the second taking 5 more minutes, how fast was the second ostrich running on average in miles per hour?

The ostriches run a total of $40 \cdot \frac{1}{4} = 10$ miles, and the second ostrich does this in $10 + 5 = 15$ minutes, which is $\frac{1}{4}$ of an hour. Then the second ostrich was running at an average speed of $\frac{10 \text{ miles}}{\frac{1}{4} \text{ hour}} = \boxed{C, 40}$ miles per hour.

20. Kate the Giraffe can reach fruit anywhere exactly 26 feet away from where she stands. If Kate wants to eat fruit at the very top of a tree 24 feet tall, how far away from the base of the tree (in feet) should Kate stand to reach this point exactly?

The point where Kate stands, the top of the tree, and the bottom of the tree form a right triangle with hypotenuse 26 and height 24. Then the base has length $\sqrt{26^2 - 24^2} = \boxed{D, 10}$, as desired.

21. Yimo wants to eat an African cichlid. Before he can eat the cichlid, he has to cook it. If the cichlid is at $70^\circ F$ and he cooks it to $175^\circ F$, how many minutes will it take Yimo to cook his cichlid if his campfire can only increase the temperature of the fish by $1.5^\circ F$ every 2 minutes?

The cichlid needs to increase by $175^\circ F - 70^\circ F = 105^\circ F$, which will take $\frac{2 \text{ mins}}{1.5^\circ F} \cdot 105^\circ F = 2 \cdot 70 = \boxed{C, 140}$ minutes.

22. Farhana and Katharine are working to assess the population change in mongooses on the Masai Mara Game Reserve. If there were 15 meerkat colonies with an average of 10 meerkats per colony in March, with 17 meerkats colonies with an average of 15 meerkats per colony in April, by how many individual meerkats did the population increase?

Initially, there are $15 \cdot 10$ meerkats, and in April, there are $17 \cdot 15$ meerkats, so the population increase by $15 \cdot 17 - 15 \cdot 10 = 15(17 - 10) = 15 \cdot 7 = \boxed{A, 105}$.

23. Shaoyang and James are snorkeling through the Congo river when they spot a Lungfish. Lungfish have lungs as suggested by their names and have to surface to breathe. If a Lungfish were to have a lung capacity of 1400 milliliters, and loses 100 milliliters of air every minute for the first 5 minutes of being submerged, and then 150 for every minute after, how long can a lungfish stay underwater for using one full breath in minutes?

After the first 5 minutes, the lungfish has $1400 - 5 \cdot 100 = 900$ milliliters of air left. This takes $900/150 = 6$ minutes to be depleted, so the answer is $5 + 6 = \boxed{B, 11}$ minutes.

24. Wes the Pigbroker is building a warthog farm, and needs to construct a pigpen for all of his hogs. The pigpen is a right triangle with a base of 6 feet and a height 3 feet less than 4 times the base, and the bedding for the pigpen costs 10 cents per square yard. What is the total cost of the bedding?

The height is $2 \cdot 6 - 3 = 9$ feet, so the area of the pen is $\frac{1}{2} \cdot 6 \cdot 9 = 27$ square feet. There are 144 square inches in a square yard, so the answer is $27 \cdot 144 \cdot \$0.10 = \boxed{D, \$388.80}$.

25. Jackson plays catch with a caracal. Caracals are excellent jumpers, and the trajectory of this particular caracal named Sid can be graphed as the parabola $y = -3(x - 7)^2 + 10$, what is the maximum height that Sid can achieve to catch Jackson's ball?

Squares are nonnegative, so $-3(x - 7)^2$ has a maximum value of 0, attained at $x = 7$. Then the answer is $0 + 10 = \boxed{B, 10}$.

26. While out trekking, David loses his favorite water bottle. This water bottle is special, however, as it is conical and named Connie the cone. If Connie has a diameter of 4, with the height being 3 times the radius, what is the volume of Connie?

The cone has radius $4/2 = 2$, so it has height $3 \cdot 2 = 6$. Then the volume of the cone is $\frac{1}{3} \cdot 2^2 \cdot 6 \cdot \pi = \boxed{B, 8\pi}$.

27. Simba needs help learning about fractions. Quick! What kind of number is $5/11$?

This is the quotient of two integers, which is a $\boxed{D, \text{rational number}}$.

28. David and Neil decide to play hopscotch with a colony of meerkats. If the number of squares on the hopscotch course is equal to the 11th prime number, what is the nonnegative difference between this number and 10?

Listing primes, we have 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, so the 11th prime number is 31, and the answer is $31 - 10 = \boxed{B, 21}$.

29. Nonoko finds a watering whole full of hippopotamus, cichlid fish, and crocodiles. If the ratio of hippos to crocodiles is 3:4 and the ratio of cichlids to crocodiles is 1:3, what is the ratio of hippos to cichlids?

For every 12 crocodiles, there are $\frac{3}{4} \cdot 12 = 9$ hippos and $\frac{1}{3} \cdot 12 = 4$ cichlids, so the ratio of hippos to cichlids is $\boxed{C, 9 : 4}$.

30. Congrats on making it to the end of the test! What is $(-23)^2 - 23^2$?

Since $(-23)^2 = 23^2$, the answer is just $\boxed{B, 0}$.