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Algebra 2 Part 2 Final Exam

Directions: Answer the questions below. Make sure to show your work and justify all your answers.

1. Bradley dropped a ball from a roof 16 feet high. Each time the ball hits the ground, it bounces $\frac{3}{5}$ the previous height. Find the height the ball will bounce after hitting the ground the fourth time.

(SHOW WORK)

2. The 2002 Denali earthquake in Alaska had a Richter scale magnitude of 6.7. The 2003 Rat Islands earthquake in Alaska had a Richter scale magnitude of 7.8.

(SHOW WORK)

Suppose an architect has designed a building strong enough to withstand an earthquake 70 times as intense as the Denali quake and 30 times as intense as the Rat Islands quake. Find which structure is strongest. **Explain your finding.**

(SHOW WORK)

3. Assume that a company sold 5.75 million motorcycles and 3.5 million cars in the year 2010. The growth in the sale of motorcycles is 16% every year and that of cars is 25% every year. Find when the sale of cars will be more than the sale of motorcycles.

(SHOW WORK)

In a survey in 2010, the population of two plant species were found to be growing exponentially. Their growth is given by these equations: species A, $P = 2000e^{0.05t}$ and species B, $P = 5000e^{0.02t}$, where $t = 0$ in the year 2010.

4. After how many years will the population of species A be equal to the population of species B in the forest?

(SHOW WORK)

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5. A raffle prize of $\frac{14x^2}{15}$ dollars is to be divided among $7x$ people. Write an expression for the amount of money that each person will receive.
(SHOW WORK)

6. The pressure exerted on the walls of a container by a gas enclosed within it is directly proportional to the temperature of the gas. If the pressure is 6 pounds per square inch when the temperature is 440°F , find the pressure exerted when the temperature of the gas is 380°F .
(SHOW WORK)

7. Blake and Ned work for a home remodeling business. They are putting the final touches on a home they renovated. Working alone, Blake can paint one room in 9 hours. Ned can paint the same room in 6 hours. How long will it take them to paint the room if they work together?
(SHOW WORK)

8. A tourist boat is used for sightseeing in a nearby river. The boat travels 2.4 miles downstream and in the same amount of time, it travels 1.8 miles upstream. If the boat travels at an average speed of 21 miles per hour in the still water, find the current of the river.
(SHOW WORK)

Sandra swims the 100-meter freestyle for her school's swim team. Her state's ranking system awards 3 points for first place, 2 points for second, 1 point for third, and 0 points if she does not place. Her coach used her statistics from last season to design a simulation using a random number generator to predict how many points she would receive in her first race this season.

Integer Value	Points Awarded	Frequency
1 - 8	3	20

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9 - 15	2	12
16 - 19	1	6
20	0	2

9. What is Sandra's expected value of points awarded for a race?
(SHOW WORK)

A carnival game has the possibility of scoring 50 points, 75 points, or 150 points per turn. The probability of scoring 50 points is 60%, 75 points is 30%, and 150 points is 10%. The game operator designed a simulation using a random number generator to predict how many points would be earned for a turn.

Integer Value	Points	Frequency
0 - 5	50	55
6 - 8	75	32
9	150	13

10. What is game's expected value of points earned for a turn?
(SHOW WORK)

11. A research company wants to test the claim that a new multivitamin helps to improve short term memory. State the objective of the experiment, suggest a population, determine the experimental and control groups, and describe a sample procedure.
(SHOW WORK)

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A medical team sent surveys to randomly selected households to determine the various health problems. The result of the survey is shown below.

Health Problems	Number of Patients
Obesity	32
Diabetes	54
Heart problems	78
Eye problems	112
Dental problems	96

Note: The survey result for each health problem is mutually exclusive.

12. Based on the survey, what is the probability that a person chosen at random is a diabetic patient or an eye patient?

(SHOW WORK)

For a short time after a wave is created by wind, the height of the wave can be modeled using $y = a \sin \frac{2\pi t}{T}$, where a is the amplitude and T is the period of the wave in seconds.

13. How many times over the first 5 seconds does the graph predict the wave to be 2 feet high?

(SHOW WORK)

14. Write an equation for the given function given the period, phase shift, and vertical shift.

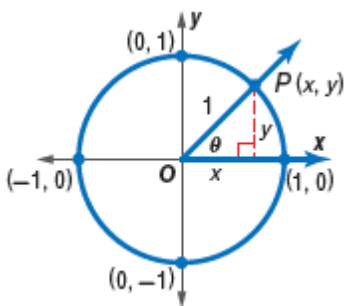
cotangent function, period = π , phase shift = $-\frac{1}{3}\pi$, vertical shift = 2

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15. Use the unit circle to find the value of $\sin \frac{3\pi}{2}$ and $\cos \frac{3\pi}{2}$.



16. Suppose θ is an angle in the standard position whose terminal side is in Quadrant IV and $\cot \theta = -\frac{6}{7}$. Find the exact values of the five remaining trigonometric functions of θ .
(SHOW WORK)

17. Verify $\sin^4 x - \sin^2 x = \cos^4 x - \cos^2 x$ is an identity.

18. Find all solutions of each equation on the interval $0 \leq x < 2\pi$.

$$\tan^2 x \sec^2 x + 2 \sec^2 x - \tan^2 x = 2$$

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19. Solve $\sin \theta + 1 = \cos 2\theta$ on the interval $0 \leq \theta < 2\pi$.

20. Verify $\sin(360^\circ - \theta) = -\sin \theta$.