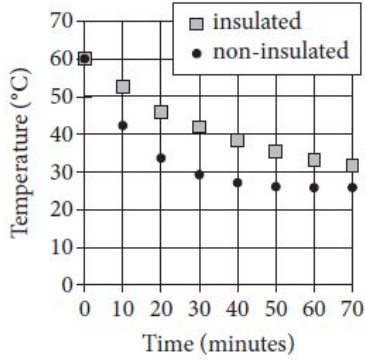## Word Problems: Level 3

1	The mesosphere is the layer of Earth's atmosphere between 50 kilometers and 85 kilometers above Earth's surface. At a distance of 50 kilometers from Earth's surface, the temperature in the mesosphere is −5° Celsius, and at a distance of 80 kilometers from Earth's surface, the temperature in the mesosphere is −80° Celsius. For every additional 10 kilometers from Earth's surface, the temperature in the mesosphere decreases by $k°$ Celsius, where k is a constant. What is the value of k ?	No Calculator
2	$$C = \frac{5}{9}(F - 32)$$ The equation above shows how a temperature F, measured in degrees Fahrenheit, relates to a temperature C, measured in degrees Celsius. Based on the equation, which of the following must be true? I. A temperature increase of 1 degree Fahrenheit is equivalent to a temperature increase of $\frac{5}{9}$ degree Celsius. II. A temperature increase of 1 degree Celsius is equivalent to a temperature increase of 1.8 degrees Fahrenheit. III. A temperature increase of $\frac{5}{9}$ degree Fahrenheit is equivalent to a temperature increase of 1 degree Celsius. A) I only B) II only C) III only D) I and II only	No Calculator
3	A radioactive substance decays at an annual rate of 13 percent. If the initial amount of the substance is 325 grams, which of the following functions f models the remaining amount of the substance, in grams, t years later? A) $f(t) = 325(0.87)^t$ B) $f(t) = 325(0.13)^t$ C) $f(t) = 0.87(325)^t$ D) $f(t) = 0.13(325)^t$	No Calculator

| 4 | Ken and Paul each ordered a sandwich at a restaurant. The price of Ken's sandwich was x dollars, and the price of Paul's sandwich was $1 more than the price of Ken's sandwich. If Ken and Paul split the cost of the sandwiches evenly and each paid a 20% tip, which of the following expressions represents the amount, in dollars, each of them paid? (Assume there is no sales tax.)

A) $0.2x + 0.2$
B) $0.5x + 0.1$
C) $1.2x + 0.6$
D) $2.4x + 1.2$ | No Calculator |

With Calculator

5	Katarina is a botanist studying the production of pears by two types of pear trees. She noticed that Type A trees produced 20 percent more pears than Type B trees did. Based on Katarina's observation, if the Type A trees produced 144 pears, how many pears did the Type B trees produce? A) 115 B) 120 C) 124 D) 173	With Calculator
6	Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was $100, and she uses the expression $100(x)^t$ to find the value of the account after t years. What is the value of x in the expression?	With Calculator
7	Jessica's friend Tyshaun found an account that earns 2.5 percent interest compounded annually. Tyshaun made an initial deposit of $100 into this account at the same time Jessica made a deposit of $100 into her account. After 10 years, how much more money will Tyshaun's initial deposit have earned than Jessica's initial deposit? (Round your answer to the nearest cent and ignore the dollar sign when gridding your response.)	With Calculator

	Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was $100, and she uses the expression $100(x)^t$ to find the value of the account after t years.	
8	A project manager estimates that a project will take x hours to complete, where $x > 100$. The goal is for the estimate to be within 10 hours of the time it will actually take to complete the project. If the manager meets the goal and it takes y hours to complete the project, which of the following inequalities represents the relationship between the estimated time and the actual completion time? A) $x + y < 10$ B) $y > x + 10$ C) $y < x - 10$ D) $-10 < y - x < 10$	With Calculator
9	$$I = \frac{P}{4\pi r^2}$$ At a large distance r from a radio antenna, the intensity of the radio signal I is related to the power of the signal P by the formula above. For the same signal emitted by a radio antenna, Observer A measures its intensity to be 16 times the intensity measured by Observer B. The distance of Observer A from the radio antenna is what fraction of the distance of Observer B from the radio antenna? A) $\frac{1}{4}$ B) $\frac{1}{16}$ C) $\frac{1}{64}$ D) $\frac{1}{256}$	With Calculator

10	Two samples of water of equal mass are heated to 60 degrees Celsius (°C). One sample is poured into an insulated container, and the other sample is poured into a non-insulated container. The samples are then left for 70 minutes to cool in a room having a temperature of 25°C. The graph above shows the temperature of each sample at 10-minute intervals. Which of the following statements correctly compares the average rates at which the temperatures of the two samples change?	With Calculator
11	A botanist is cultivating a rare species of plant in a controlled environment and currently has 3000 of these plants. The population of this species that the botanist expects to grow next year, $N_{next\ year}$, can be estimated from the number of plants this year, $N_{this\ year}$, by the equation below. $$N_{next\ year} = N_{this\ year} + 0.2\left(N_{this\ year}\right)\left(1 - \frac{N_{this\ year}}{K}\right)$$ The constant K in this formula is the number of plants the environment is able to support. The botanist would like to increase the number of plants that the environment can support so that the population of the species will increase more rapidly. If the botanist's goal is that the number of plants will increase from 3000 this year to 3360 next year, how many plants must the modified environment support?	With Calculator

12	Of the following four types of savings account plans, which option would yield exponential growth of the money in the account? A) Each successive year, 2% of the initial savings is added to the value of the account. B) Each successive year, 1.5% of the initial savings and $100 is added to the value of the account. C) Each successive year, 1% of the current value is added to the value of the account. D) Each successive year, $100 is added to the value of the account.	With Calculator
13	Mr. Kohl has a beaker containing n milliliters of solution to distribute to the students in his chemistry class. If he gives each student 3 milliliters of solution, he will have 5 milliliters left over. In order to give each student 4 milliliters of solution, he will need an additional 21 milliliters. How many students are in the class? A) 16 B) 21 C) 23 D) 26	With Calculator
14	In planning maintenance for a city's infrastructure, a civil engineer estimates that, starting from the present, the population of the city will decrease by 10 percent every 20 years. If the present population of the city is 50,000, which of the following expressions represents the engineer's estimate of the population of the city t years from now? A) $50,000(0.1)^{20t}$ B) $50,000(0.1)^{\frac{t}{20}}$ C) $50,000(0.9)^{20t}$ D) $50,000(0.9)^{\frac{t}{20}}$	With Calculator

15		With Calculator

	Handedness	
Gender	Left	Right
Female		
Male		
Total	18	122

The incomplete table above summarizes the number of left-handed students and right-handed students by gender for the eighth-grade students at Keisel Middle School. There are 5 times as many right-handed female students as there are left-handed female students, and there are 9 times as many right-handed male students as there are left-handed male students. If there is a total of 18 left-handed students and 122 right-handed students in the school, which of the following is closest to the probability that a right-handed student selected at random is female? (Note: Assume that none of the eighth-grade students are both right-handed and left-handed.)

A) 0.410

B) 0.357

C) 0.333

D) 0.250

16		With Calculator

If shoppers enter a store at an average rate of r shoppers per minute and each stays in the store for an average time of T minutes, the average number of shoppers in the store, N, at any one time is given by the formula $N = rT$. This relationship is known as Little's law.

The owner of the Good Deals Store estimates that during business hours, an average of 3 shoppers per minute enter the store and that each of them stays an average of 15 minutes. The store owner uses Little's law to estimate that there are 45 shoppers in the store at any time.

Little's law can be applied to any part of the store, such as a particular department or the checkout lines. The store owner determines that, during business hours, approximately 84 shoppers per hour make a purchase and each of these shoppers spend an average of 5 minutes in the checkout line. At any time during business hours, about how many shoppers, on average, are waiting in the checkout line to make a purchase at the Good Deals Store?

17	The owner of the Good Deals Store opens a new store across town. For the new store, the owner estimates that, during business hours, an average of 90 shoppers per <u>hour</u> enter the store and each of them stays an average of 12 minutes. The average number of shoppers in the new store at any time is what percent less than the average number of shoppers in the original store at any time? (Note: Ignore the percent symbol when entering your answer. For example, if the answer is 42.1%, enter 42.1)	With Calculator
18	$$q = \frac{1}{2}nv^2$$ The dynamic pressure q generated by a fluid moving with velocity v can be found using the formula above, where n is the constant density of the fluid. An aeronautical engineer uses the formula to find the dynamic pressure of a fluid moving with velocity v and the same fluid moving with velocity $1.5v$. What is the ratio of the dynamic pressure of the faster fluid to the dynamic pressure of the slower fluid?	With Calculator
19	The stock price of one share in a certain company is worth $360 today. A stock analyst believes that the stock will lose 28 percent of its value each week for the next three weeks. The analyst uses the equation $V = 360(r)^t$ to model the value, V, of the stock after t weeks. What value should the analyst use for r ?	With Calculator
20	The stock price of one share in a certain company is worth $360 today. A stock analyst believes that the stock will lose 28 percent of its value each week for the next three weeks. The analyst uses the equation $V = 360(r)^t$ to model the value, V, of the stock after t weeks. To the nearest dollar, what does the analyst believe the value of the stock will be at the end of three weeks? (Note: Disregard the $ sign when gridding your answer.)	With Calculator

21	$h = -4.9t^2 + 25t$ The equation above expresses the approximate height h, in meters, of a ball t seconds after it is launched vertically upward from the ground with an initial velocity of 25 meters per second. After approximately how many seconds will the ball hit the ground? A) 3.5 B) 4.0 C) 4.5 D) 5.0	
22	A botanist is cultivating a rare species of plant in a controlled environment and currently has 3000 of these plants. The population of this species that the botanist expects to grow next year, $N_{next\ year}$, can be estimated from the number of plants this year, $N_{this\ year}$, by the equation below. $$N_{next\ year} = N_{this\ year} + 0.2\left(N_{this\ year}\right)\left(1 - \frac{N_{this\ year}}{K}\right)$$ The constant K in this formula is the number of plants the environment is able to support. According to the formula, what will be the number of plants two years from now if $K = 4000$? (Round your answer to the nearest whole number.)	With Calculator