

1. In the desert biome, the temperature can range greatly from day to night. A typical range in Celsius would be $-18^{\circ} \leq C \leq 20^{\circ}$. Given the formula $F = \frac{9}{5}C + 32$, where F is the temperature in degrees Fahrenheit and C is the temperature in degrees Celsius, what would this biome's temperature range be in Fahrenheit?
 - A. $1.4^{\circ} \leq F \leq 72^{\circ}$
 - B. $22^{\circ} \leq F \leq 43.11^{\circ}$
 - C. $64.4^{\circ} \leq F \leq 68^{\circ}$
 - D. $-0.4^{\circ} \leq F \leq 68^{\circ}$
 - E. $22^{\circ} \leq F \leq 68^{\circ}$
2. Candice deposits \$2,000 at 5% annual interest compounded yearly at a bank which use the formula $A = P(1+r)^n$, where A is the current value; P is the amount deposited initially; r is the rate of interest for one compounding period, expressed as a decimal; and n is the number of periods, to determine the current value of the account. Which of the following would be the approximate value of the account after 10 years?
 - A. \$35
 - B. \$1228
 - C. \$3258
 - D. \$21000
 - E. \$115330
3. The number of clients Candy Cane Cable acquired in each year can be modeled by the function $C(t) = 800t + 250$, where $t = 0$ corresponds to the year 1999. Using the given model, how many clients would you expect Candy Cane Cable to acquire in the year 2007?
 - A. 1605850
 - B. 64250
 - C. 7450
 - D. 5850
 - E. 6650
4. The time, t seconds, required for a simple pendulum x feet long to make 1 complete swing can be modeled by $t = 4\pi\sqrt{\frac{x}{12}}$. How many seconds will it take for a simple pendulum that is 3 feet long to make one complete swing?
 - A. Between 7 and 8 seconds
 - B. Between 6 and 7 seconds
 - C. Between 2 and 3 seconds
 - D. Between 1 and 2 seconds
 - E. Less than 1 second
5. For a certain species of frog, the optimal temperature range for the tadpoles in degrees Celsius is $20^{\circ} \leq C \leq 35^{\circ}$. The conversion from Celsius to Fahrenheit is $F = \frac{9}{5}C + 32$. What is the optimal temperature range for the tadpoles in degrees Fahrenheit?
 - A. $68^{\circ} \leq F \leq 95^{\circ}$
 - B. $68^{\circ} \leq F \leq 51.44^{\circ}$
 - C. $43.11^{\circ} \leq F \leq 95^{\circ}$
 - D. $43.11^{\circ} \leq F \leq 51.44^{\circ}$
 - E. $36^{\circ} \leq F \leq 63^{\circ}$
6. Jose invested \$1400 in a high-yield savings account. In 7 months, his investment had earned a \$62 interest. To the nearest tenth, what is Jose's annual interest rate? (Use $I = Prt$, where I is the amount of interest earned, P is the initial investment, r is the interest rate, and t is the time, in years.)
 - A. 0.6%
 - B. 7.6%
 - C. 14.3%
 - D. 8.9%
 - E. 10.6%

7. $y = a(1-r)^x$ is an equation that models decay. a is the initial amount before decay, r is the rate of decay, and x is the number of time intervals that have passed. A certain element decays by 12% every hour. If there are 500 grams of this element at 5:00 AM, which expression shows how many grams will be left at 11:00 AM the same day?
- A. $500(1+.12)^6$
B. $500(1-12)^6$
C. $500(12)^6$
D. $500(.12)^6$
E. $500(1-.12)^6$
8. The length L , in centimeters, of a simple pendulum is given by the equation $L = \frac{gT^2}{4\pi^2}$, where g is the acceleration of gravity in meters per second squared. What is the length of the pendulum, knowing that the acceleration due to gravity is $9.8m/s^2$ and the period of the pendulum is $3.5s$?
- A. 2.63
B. 3.04
C. 3.63
D. 4
E. 5.21
9. A ball is kicked into the air from ground. Its height, h feet above ground, t seconds after it is launched, is given by $h = -16t^2 + 64t$. During the ball's descent, at what value of t is the ball 48 feet off of the ground?
- A. 3
B. 1
C. 2
D. 4
E. 5
10. A microwave company's profit, P dollars, when m microwaves are made and sold can be modeled by $P = m^2 - 400m - 120,000$. What is the least number of microwaves the company must make and sell in order for the company to not lose money on this production run?
- A. 400
B. 500
C. 550
D. 600
E. 650
11. The amount, in kilograms, of usable wood left in a wood-burning furnace starting with 25 kilograms of wood can be approximated by the equation $y = 25 - 2.5h$, where h is the number of hours the stove has been burning for $0 \leq h \leq 10$, and y is the number of kilograms of wood remaining. According to this equation, which of the following statements is true about the stove?
- A. After burning for 1 hour, the furnace still has 22.5 kilograms of wood left.
B. After burning for 1 hour, the furnace has used 22.5 kilograms of wood.
C. After burning for 2.5 hours, the furnace has used 2.5 kilograms of wood.
D. After burning for 9 hours, the furnace still has 22.5 kilograms of wood.
E. After burning for 0.5 hours, the furnace has burned 5 kilograms of wood.
12. Temperatures measured in degrees Fahrenheit (F) are related to temperatures measured in degrees Celsius (C) by the formula $F = \frac{9}{5}C + 32$. There is 1 value of x for which x degrees Fahrenheit equals $x - 30$ degrees Celsius. What is that value?
- A. -77.5
B. -2.5
C. 5.75
D. 27.5
E. 77.5
13. A triangle has an angle measuring 60° and the leg opposite that measures 30 inches. One of the legs adjacent to the 60° angle has a changing length corresponding to $f(t) = 80 + 2t - 2t^2$ inches, starting from $t = 0$ where t is the time in seconds. What is the time, t , at which the resulting triangle will have an area that is $\frac{1}{2}$ that of the original triangle?
- A. 4 seconds
B. 5 seconds
C. 6 seconds
D. 7 seconds
E. 8 seconds

14. The distance, d in meters, that an accelerating object travels is given by $d = \frac{1}{2}at^2$, where a is the acceleration rate in meters per second per second and t is the time in seconds. A motorbike accelerates from a stop with an acceleration of 40 meters per second squared over a distance of 60 meters. About how many seconds did the motorbike travel?

A. Between 4 and 5
B. Between 2 and 3
C. 1
D. Between 1 and 2
E. 2

15. A children's wind-up car toy travels a distance, d inches, as modeled by the function $d = 12 + 8t$ where t is the number of seconds after the car has been wound up and released. If the car is released at 12 feet, to the nearest second, how many seconds would it take to reach 21 feet?

A. 10
B. 11
C. 12
D. 13
E. 14

ANSWER KEY

1. D 2. C 3. E 4. B 5. A 6. B 7. E 8. B 9. A 10. D 11. A 12. D 13. B 14. D
15. C

ANSWER EXPLANATIONS

1. **D.** Converting the lower bound of the range from Celsius to Fahrenheit, we get $F = \frac{9}{5}(-18) + 32 \rightarrow -\frac{162}{5} + 32 = -32.4 + 32 \rightarrow -0.4$. Converting the upper bound of the range from Celsius to Fahrenheit, we get $F = \frac{9}{5}(20) + 32 \rightarrow \frac{180}{5} + 32 = 36 + 32 \rightarrow 68$. So, the range of temperature in Fahrenheit is $-0.4 \leq F \leq 68$.
2. **C.** We are given that $P = 2000$, $r = 0.05$, and $n = 10$. Plugging these values into the equation $A = P(1+r)^n$, we solve for A . $A = 2000(1+0.05)^{10} \rightarrow 2000(1.05)^{10} \rightarrow 3257.79 \approx 3258$.
3. **E.** Since $t = 0$ corresponds to the year 1999, the year 2007 corresponds to when $t = 2007 - 1999 = 8$. So, plugging in $t = 8$, we get $C(8) = 800(8) + 250 \rightarrow 6400 + 250 = 6650$.
4. **B.** Plugging in $x = 3$, we get $t = 4\pi\sqrt{\frac{3}{12}} = 4\pi\sqrt{\frac{1}{4}} = 4\pi\left(\frac{1}{2}\right) = 2\pi$. The value of 2π is ≈ 6.28 which is between 6 and 7 seconds.
5. **A.** Converting the lower bound of the range from Celsius to Fahrenheit, we get $F = \frac{9}{5}(20) + 32 \rightarrow \frac{180}{5} + 32 \rightarrow 36 + 32 = 68$.
Converting the upper bound of the range from Celsius to Fahrenheit, we get $F = \frac{9}{5}(35) + 32 \rightarrow \frac{315}{5} + 32 \rightarrow 63 + 32 = 95$.
So, the range of temperature in Fahrenheit is $68 \leq F \leq 95$.
6. **B.** We first need to know that 7 months is equal to $\frac{7}{12}$ years. Plugging in $I = 62$, $P = 1400$, and $t = \frac{7}{12}$ into $I = Prt$, we get $62 = 1400r\left(\frac{7}{12}\right)$. Dividing both sides by $(1400)\left(\frac{7}{12}\right)$, we get $r = 0.0759$. So, the interest rate r is approximately 7.6%.
7. **E.** $r = 0.12$, $a = 500$, and $x = 6$. Plugging these values into the given formula, we get $y = 500(1 - 0.12)^6$.
8. **B.** This problem is as simple as plugging numbers into their respective variables and putting the expression into your calculator. Plugging the values given for time and acceleration due to gravity, we get $L = \frac{9.8m/s^2 * (3.5s)^2}{4 * \pi^2} \approx 3.04$.
9. **A.** The question gives us the value of t and wants us to find the value of h that makes the equation true. So, plugging in $h = 48$, we get $-16x^2 + 64x = -48$. Moving all the values to the right side of the equation, we get $0 = -16x^2 + 64x - 48$. Factoring out, 16 we get $16(-x^2 + 4x - 3)$. Now, factoring the polynomial inside the parenthesis, we get $16(-x + 1)(x - 3) = 0$. This gives us two t values of 1 and 3, but the problem asks for the time at which the ball has a height of 48 feet AND is descending. Because the ball is kicked from rest, rises, and then falls, the time closer to 0 ($t = 1$) will be when the ball is rising, so the time further from 0 ($t = 3$) will be when the ball is falling and is the correct answer.

10. **D.** For the company to not lose money, the profit P must be zero or positive. Setting $P=0$ and solving for m would give us the least amount of microwaves the company must sell for the company to not lose money. We have $0 = m^2 - 400m - 120,000$. To solve for n , we must find two numbers that add up to equal -400 and multiply to be $-120,000$. The numbers -600 and 200 satisfy these conditions, so we can factor the equation to be $(m-600)(m+200)=0$. This means $m-600=0 \rightarrow m=600$ or $m+200=0 \rightarrow m=-200$. The positive value for m is our answer because the company cannot sell a negative number of microwaves.
11. **A.** The equation $y = 25 - 2.5h$ has a y -intercept of 25 and a slope of -2.5 . This means that for every hour (h), the amount of wood (y) is decreasing by 2.5 . So, running through the answer choices, we see that for answer choice A, after burning for 1 hour, the furnace still has 22.5 kilograms of wood left. This is true because the amount of wood left after 1 hour is equivalent to the equation evaluated at $h=1$. This gives us $y = 25 - 2.5 \cdot 1 = 22.5$. So there are 22.5 kilograms of wood left after 1 hour.
12. **D.** If x degrees Fahrenheit equals $x - 30$ degrees Celsius, we can plug these values into our formula as $x = \frac{9}{5}(x - 30) + 32$. Distributing the $\frac{9}{5}$ gets us $x = \frac{9}{5}x - 54 + 32$. This simplifies to $\frac{4}{5}x = 22$. Multiplying each side by $\frac{5}{4}$ isolates the x to get $x = \frac{55}{2} = 27.5$.
13. **B.** The area of a triangle is equal to any of the bases times the corresponding height (the height is the length of the altitude drawn from the point opposite the base). Since the point opposite the leg with a changing length does not move, neither does the altitude, so the height is constant. Therefore, if the base doubles its area or halves its length, the area will also double or halve, respectively. At $t=0$, the length is 80. To find when the area is $\frac{1}{2}$ that of the original triangle, we need to find the time when the length of the leg is $\frac{1}{2} \cdot 80 = 40$. Set up our equation as $80 + 2t - 2t^2 = 40$ and rearrange to $2t^2 - 2t - 40 = 0$. This simplifies to $t^2 - t - 20 = 0$. This factors into $(t+4)(t-5) = 0$. The solutions are $t = -4$ and $t = 5$. t can only be a positive value, so the solution is 5 seconds.
14. **D.** Plugging in $d = 60$ and $a = 40$, we have $60 = \frac{1}{2}(40)t^2$. Dividing by 20 on both sides, we get $3 = t^2$ or $t = \sqrt{3}$. Since $\sqrt{1} < \sqrt{3} < \sqrt{4}$, $\sqrt{3}$ is between 1 and 2.
15. **C.** The car must travel 9 feet, which is $9 \cdot 12 = 108$ inches. So, we plug in 108 for the distance d and solve for the time t . We get $108 = 12 + 8t \rightarrow 96 = 8t \rightarrow t = 12$.