Name: _____

F.IF.B.4: Evaluating Exponential Functions

1 For a recently released movie, the function $y = 119.67(0.61)^x$ models the revenue earned, y, in millions of dollars each week, x, for several weeks after its release. Based on the equation, how much more money, in millions of dollars, was earned in revenue for week 3 than for week 5?
1) 37.27 2) 27.16 3) 17.06 4) 10.11

2 The value, y, of a \$15,000 investment over x years is represented by the equation $y = 15000(1.2)^{\frac{x}{3}}$. What is the profit (interest) on a 6-year investment?
1) \$6,600 2) \$10,799 3) \$21,600 4) \$25,799

3 Kathy deposits \$25 into an investment account with an annual rate of 5%, compounded annually. The amount in her account can be determined by the formula $A = P(1 + R)^t$, where P is the amount deposited, R is the annual interest rate, and t is the number of years the money is invested. If she makes no other deposits or withdrawals, how much money will be in her account at the end of 15 years?
1) \$25.75 2) \$43.75 3) \$51.97 4) \$393.97

4 If \$5000 is invested at a rate of 3% interest compounded quarterly, what is the value of the investment in 5 years? (Use the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where A is the amount accrued, P is the principal, r is the interest rate, n is the number of times per year the money is compounded, and t is the length of time, in years.)
1) \$5190.33 2) \$5796.37 3) \$5805.92 4) \$5808.08

5 Yusef deposits \$50 into a savings account that pays 3.25% interest compounded quarterly. The amount, A, in his account can be determined by the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where P is the initial amount invested, r is the interest rate, n is the number of times per year the money is compounded, and t is the number of years for which the money is invested. What will his investment be worth in 12 years if he makes no other deposits or withdrawals?
1) \$55.10 2) \$73.73 3) \$232.11 4) \$619.74

6 The Franklins inherited \$3,500, which they want to invest for their child's future college expenses. If they invest it at 8.25% with interest compounded monthly, determine the value of the account, in dollars, after 5 years. Use the formula $A = P\left(1 + \frac{r}{n}\right)^{nt}$, where A = value of the investment after t years, P = principal invested, r = annual interest rate, and n = number of times compounded per year.

7 Five thousand dollars is invested at an interest rate of 3.5% compounded quarterly. No money is deposited or withdrawn from the account. Using the formula below, determine, to the *nearest cent*, how much this investment will be worth in 18 years.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

A = amount

P = principal

r = interest rate

n = number of times the interest rate compounded annually

t = time in years

8 Robert is buying a car that costs $22,000. After a down payment of $4000, he borrows the remainder from a bank, a six year loan at 6.24% annual interest rate. The following formula can be used to calculate his monthly loan payment.

$$R = \frac{(P)(i)}{1 - (1 + i)^{-t}}$$

R = monthly payment
P = loan amount
i = monthly interest rate
t = time, in months

Robert's monthly payment will be
1) $298.31 2) $300.36 3) $307.35 4) $367.10

9 The George family would like to borrow $45,000 to purchase a new boat. They qualified for a loan with an annual interest rate of 6.75%. The monthly loan payment can be found using the formula below.

$$M = \frac{P\left(\frac{r}{12}\right)\left(1 + \frac{r}{12}\right)^{n}}{\left(1 + \frac{r}{12}\right)^{n} - 1}$$

M = monthly payment
P = amount borrowed
r = annual interest rate
n = number of monthly payments

What is the monthly payment if they would like to pay off the loan in five years?
1) $262.99 2) $252.13 3) $915.24 4) $885.76

10 Monthly mortgage payments can be found using the formula below, where M is the monthly payment, P is the amount borrowed, r is the annual interest rate, and n is the total number of monthly payments.

$$M = \frac{P\left(\frac{r}{12}\right)\left(1+\frac{r}{12}\right)^{n}}{\left(1+\frac{r}{12}\right)^{n}-1}$$

If Adam takes out a 15-year mortgage, borrowing \$240,000 at an annual interest rate of 4.5%, his monthly payment will be

1) \$1379.09 2) \$1604.80 3) \$1835.98 4) \$9011.94

11 The Wells family is looking to purchase a home in a suburb of Rochester with a 30-year mortgage that has an annual interest rate of 3.6%. The house the family wants to purchase is \$152,500 and they will make a \$15,250 down payment and borrow the remainder. Use the formula below to determine their monthly payment, to the *nearest dollar*.

$$M = \frac{P\left(\frac{r}{12}\right)\left(1+\frac{r}{12}\right)^{n}}{\left(1+\frac{r}{12}\right)^{n}-1}$$

M = monthly payment
P = amount borrowed
r = annual interest rate
n = total number of monthly payments

12 Using the formula below, determine the monthly payment on a 5-year car loan with a monthly percentage rate of 0.625% for a car with an original cost of \$21,000 and a \$1000 down payment, to the *nearest cent*.

$$P_n = PMT\left(\frac{1-(1+i)^{-n}}{i}\right)$$

P_n = present amount borrowed
n = number of monthly pay periods
PMT = monthly payment
i = interest rate per month

The affordable monthly payment is \$300 for the same time period. Determine an appropriate down payment, to the *nearest dollar*.

13 Jim is looking to buy a vacation home for $172,600 near his favorite southern beach. The formula to compute a mortgage payment, M, is $M = P \bullet \frac{r(1+r)^N}{(1+r)^N - 1}$ where P is the principal amount of the loan, r is the monthly interest rate, and N is the number of monthly payments. Jim's bank offers a monthly interest rate of 0.305% for a 15-year mortgage. With no down payment, determine Jim's mortgage payment, rounded to the *nearest dollar*. Algebraically determine and state the down payment, rounded to the *nearest dollar*, that Jim needs to make in order for his mortgage payment to be $1100.

14 The temperature, F, in degrees Fahrenheit, after t hours of a roast put into an oven is given by the equation $F = 325 - 185e^{-0.4t}$. What was the temperature of the roast when it was put into the oven?
1) 325 2) 200 3) 185 4) 140

15 The formula to determine continuously compounded interest is $A = Pe^{rt}$, where A is the amount of money in the account, P is the initial investment, r is the interest rate, and t is the time, in years. Which equation could be used to determine the value of an account with an $18,000 initial investment, at an interest rate of 1.25% for 24 months?
1) $A = 18{,}000e^{1.25 \bullet 2}$ 2) $A = 18{,}000e^{1.25 \bullet 24}$ 3) $A = 18{,}000e^{0.0125 \bullet 2}$ 4) $A = 18{,}000e^{0.0125 \bullet 24}$

16 The amount of money in an account can be determined by the formula $A = Pe^{rt}$, where P is the initial investment, r is the annual interest rate, and t is the number of years the money was invested. What is the value of a $5000 investment after 18 years, if it was invested at 4% interest compounded continuously?
1) $9367.30 2) $9869.39 3) $10,129.08 4) $10,272.17

17 The formula for continuously compounded interest is $A = Pe^{rt}$, where A is the amount of money in the account, P is the initial investment, r is the interest rate, and t is the time in years. Using the formula, determine, to the *nearest dollar*, the amount in the account after 8 years if $750 is invested at an annual rate of 3%.

18 Matt places $1,200 in an investment account earning an annual rate of 6.5%, compounded continuously. Using the formula $V = Pe^{rt}$, where V is the value of the account in t years, P is the principal initially invested, e is the base of a natural logarithm, and r is the rate of interest, determine the amount of money, to the *nearest cent*, that Matt will have in the account after 10 years.

19 Emma's parents deposited $5000 into a bank account during her freshman year. The account pays 5% interest compounded continuously using the formula $A = Pe^{rt}$, where A is the total amount accrued, P is the principal, r is the annual interest rate, and t is time, in years. Determine, to the *nearest dollar*, the amount in the account 4 years later.

20 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

F.IF.B.4: Evaluating Exponential Functions
Answer Section

1 ANS: 3
$119.67(0.61)^5 - 119.67(0.61)^3 \approx 17.06$

REF: 011603ai

2 ANS: 1
$15000(1.2)^{\frac{6}{3}} = 21,600.\ 21,600 - 15,000 = 6,600$

REF: 061030ia

3 ANS: 3
$A = P(1+R)^t = 25(1+.05)^{15} \approx 51.97$

REF: 060803b

4 ANS: 3
$5000\left(1+\frac{.03}{4}\right)^{4\cdot 5} = 5000(1.0075)^{20} \approx 5805.92$

REF: 011410a2

5 ANS: 2
$A = 50\left(1+\frac{.0325}{4}\right)^{4\cdot 12} = 50(1.008125)^{48} \approx 73.73$

REF: 081511a2

6 ANS:
$5,279.61.\quad A = P(1+\frac{r}{n})^{nt} = 3500(1+\frac{.0825}{12})^{12\times 5} \approx 5279.61$

REF: 080224b

7 ANS:
$A = 5000\left(1+\frac{.035}{4}\right)^{4\cdot 18} \approx 9362.36$

REF: 061629a2

8 ANS: 2
$i = \frac{6.24\%}{12} = .52\%\ \ R = \frac{(18000)(.52\%)}{1-(1+.52\%)^{-12\cdot 6}} \approx 300.36$

REF: 012420aii

9 ANS: 4

$$M = \frac{45000\left(\frac{6.75\%}{12}\right)\left(1+\frac{6.75\%}{12}\right)^{5\times 12}}{\left(1+\frac{6.75\%}{12}\right)^{5\times 12}-1} \approx 885.76$$

REF: 082316aii

10 ANS: 3

$$M = \frac{240000\left(\frac{4.5\%}{12}\right)\left(1+\frac{4.5\%}{12}\right)^{15\times 12}}{\left(1+\frac{4.5\%}{12}\right)^{15\times 12}-1} \approx 1835.98$$

REF: 062209aii

11 ANS:

$$M = \frac{(152500-15250)\left(\frac{.036}{12}\right)\left(1+\frac{.036}{12}\right)^{360}}{\left(1+\frac{.036}{12}\right)^{360}-1} \approx 624$$

REF: 061831aii

12 ANS:

$$20000 = PMT\left(\frac{1-(1+.00625)^{-60}}{0.00625}\right) \quad 21000 - x = 300\left(\frac{1-(1+.00625)^{-60}}{0.00625}\right)$$

$$PMT \approx 400.76 \qquad x \approx 6028$$

REF: 011736aii

13 ANS:

$$M = 172600 \bullet \frac{0.00305(1+0.00305)^{12\cdot 15}}{(1+0.00305)^{12\cdot 15}-1} \approx 1247 \qquad 1100 = (172600-x) \bullet \frac{0.00305(1+0.00305)^{12\cdot 15}}{(1+0.00305)^{12\cdot 15}-1}$$

$$1100 \approx (172600-x) \bullet (0.007228)$$

$$152193 \approx 172600 - x$$

$$20407 \approx x$$

REF: 061734aii

14 ANS: 4

$F = 325 - 185e^{-0.4(0)} = 325 - 185 = 140$

REF: 012415aii

15 ANS: 3 REF: 061416a2

16 ANS: 4

$A = 5000e^{(.04)(18)} \approx 10272.17$

REF: 011607a2

17 ANS:

$A = 750e^{(0.03)(8)} \approx 953$

REF: 061229a2

18 ANS:

2,298.65

REF: fall0932a2

19 ANS:

$A = 5000e^{0.05 \cdot 4} \approx 6107$

REF: 081629a2

20 ANS:

$G(30) = 500e^{0.216(30)} \approx 325,985$

REF: 011728a2