

**0126aii Regents Exam**

1 The value of  $t$  in the equation  $27^{6-t} = 9^{t-1}$  is

- |                   |      |
|-------------------|------|
| 1) $\frac{7}{2}$  | 3) 8 |
| 2) $\frac{19}{5}$ | 4) 4 |

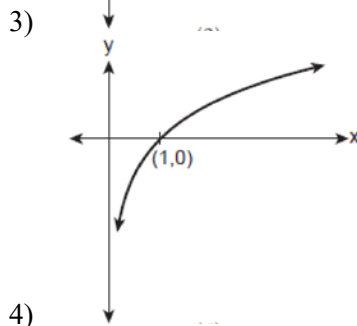
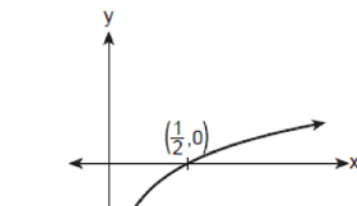
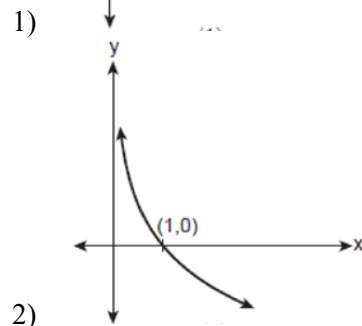
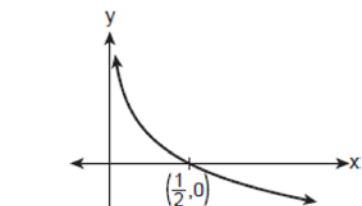
2 Which expression is equivalent to  $(x - 4)^2 - 5(x - 4) + 6$ ?

- |                     |                      |
|---------------------|----------------------|
| 1) $(x - 2)(x - 1)$ | 3) $(x - 10)(x - 5)$ |
| 2) $(x + 2)(x - 3)$ | 4) $(x - 6)(x - 7)$  |

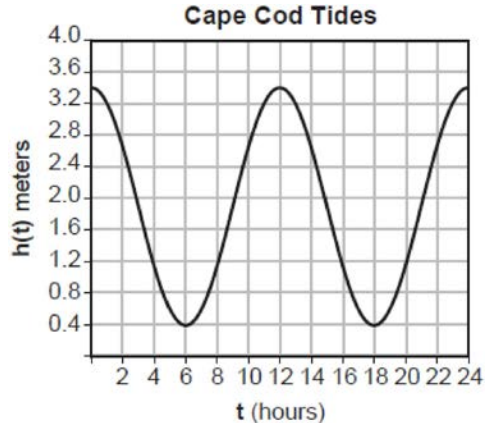
3 Researchers wanted to determine if listening to classical music can reduce math anxiety. They divided 100 students randomly into two groups and put them in identical rooms. Both groups completed a math test and a survey rating their level of math anxiety. One group then listened to classical music for 10 minutes while the other group sat quietly. Both groups then took another math test, rated their level of math anxiety, and the researchers compared their results. Is this an observational study or an experiment?

- |   |  |
|---|--|
| 1) It is an observational study because the participants completed a survey about math anxiety.   | 3) It is an experiment because one group was randomly assigned to listen to classical music while the other group was not. |
| 2) It is an observational study because the researchers watched the participants take math tests. | 4) It is an experiment because the participants took a math test.  |

4 Which graph represents the function  $y = \log_{\frac{1}{2}}(x)$ ?



- 5 The height of the water at Cape Cod, Massachusetts, is shown on the graph below.



If the height of the water,  $h(t)$ , is measured in meters and time,  $t$ , is measured in hours since high tide, what is an equation for the height of the water?

- 1)  $h(t) = 1.9 \cos\left(\frac{\pi}{6}t\right) + 1.5$                       3)  $h(t) = 1.9 \cos\left(\frac{\pi}{12}t\right) + 1.5$   
 2)  $h(t) = 1.5 \cos\left(\frac{\pi}{6}t\right) + 1.9$                       4)  $h(t) = 1.5 \cos\left(\frac{\pi}{12}t\right) + 1.9$

- 6 The solutions to  $3x^2 - 4x + 2 = 0$  are

- 1)  $x = \frac{2}{3} \pm \frac{\sqrt{2}}{3}i$     3)  $\frac{2}{3} \pm \frac{\sqrt{2}}{3}$   
 2)  $x = \frac{2}{3} \pm \frac{\sqrt{10}}{3}i$     4)  $x = \frac{2}{3} \pm \frac{\sqrt{10}}{3}i$

- 7 The value of  $\sin\left(\frac{2\pi}{3}\right)$  is equivalent to

- 1)  $\sin\left(\frac{4\pi}{3}\right)$     3)  $\tan\left(\frac{\pi}{3}\right)$   
 2)  $\cos\left(\frac{\pi}{6}\right)$     4)  $\csc\left(\frac{2\pi}{3}\right)$

- 8 Given  $f^{-1}(x) = \sqrt[3]{4x+1}$ , which function represents  $f(x)$ ?

- 1)  $f(x) = \sqrt[3]{\frac{1}{4}x - 1}$     3)  $f(x) = \frac{1}{4}(x^3 - 1)$   
 2)  $f(x) = (4x + 1)^3$     4)  $f(x) = \frac{x^3}{4} - 1$

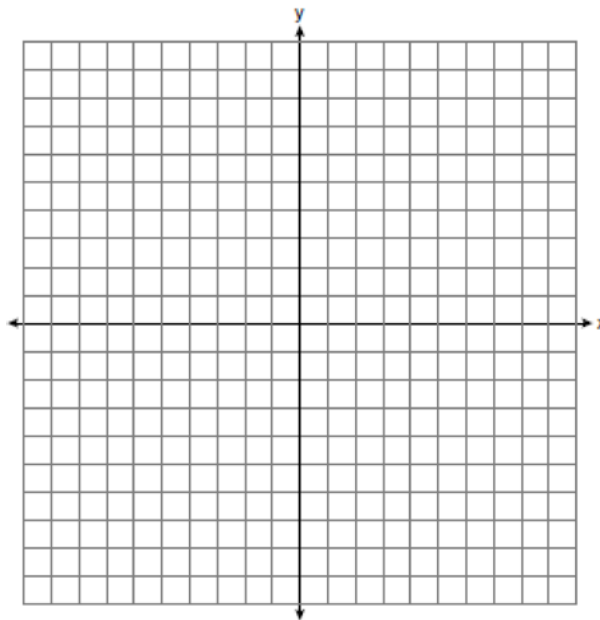








- 25 The number of people at a concert  $t$  hours after the doors open can be modeled by the equation  $B(t) = 250(1.8)^t$ . Determine how much time, to the *nearest hundredth of an hour*, must pass before the number of people reaches 2000.
- 26 On a day in June 2017 on Staten Island, the function  $T(h) = 8 \sin\left(\frac{\pi}{12}h\right) + 82$  was used to model the temperature,  $T$ , in degrees Fahrenheit,  $h$  hours after 9 a.m. State the value of  $T(6)$  and explain its meaning in this context.
- 27 Use properties of exponents to show why  $(-64)^{\frac{2}{3}} = 16$ . Justify your answer.
- 28 Graph  $y = 2^x - 2$  on the axes below.



State the equation of the asymptote.

- 29 In a survey of students at a large high school, 58% speak English fluently, 24% speak Mandarin fluently, and 16% speak English and Mandarin fluently. Determine the percentage of students at the school who speak English or Mandarin fluently.

- 30 The following table represents the number of years after 1980,  $x$ , and the median value of a home in the United States in thousands of dollars,  $y$ .

$x$	1	10	20	30	40
$y$	59.07	97.02	131.6	180.7	269.2

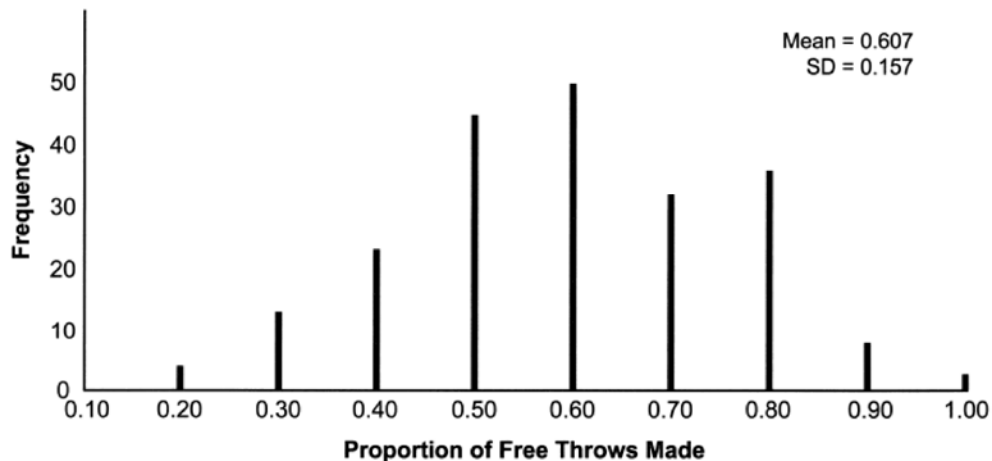
Based on these data, write an exponential regression equation to model the median home value, in thousands of dollars,  $x$  years after 1980. Round all coefficients to the *nearest hundredth*.

- 31 Solve algebraically for all values of  $x$  that satisfy the equation below.

$$\frac{24}{x^2 + 4x} + \frac{x}{x + 4} = \frac{5}{x}$$

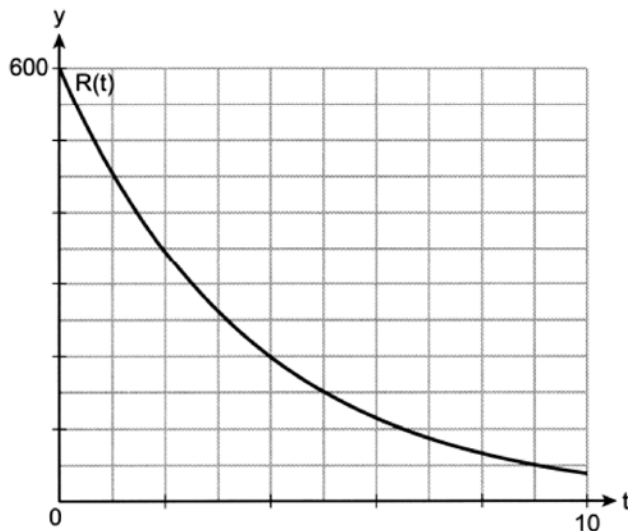
- 32 Express  $i(x + i) - (x - i)^2$  in simplest  $a + bi$  form.

- 33 On a high school basketball team, Alex typically makes 60% of his free throws. In the last four minutes of the game, Alex took 10 free throws and made 30% of them. Fans were saying he missed on purpose. A simulation was run of sample size 10, simulated 200 times, based on the premise that 60% of the free throws were made. The approximately normal results are shown below.



Based on the simulation, determine an interval containing the middle 95% of simulated values. State your answer to three decimal places. Do the fans have a valid argument? Explain using statistical evidence.

- 34 The breakdown of a drug is modeled by  $A(t) = A_0 e^{-rt}$  where  $A(t)$  is the amount of the drug in the body,  $A_0$  is the initial dosage,  $r$  is the rate of decay, and  $t$  is the time in hours. A patient is given 450 mg of a drug that has a decay rate of 0.205. Write a function,  $A(t)$ , to model the amount of the drug remaining in the body after  $t$  hours. The sketch below shows the function  $R(t)$ , which models the breakdown of a different drug administered to the same patient. Graph  $A(t)$  on the grid below.



Using the graph, approximate to the *nearest hour* when the patient has the same amount of both drugs remaining.

- 35 Consider the sinusoidal function below.

$$d(t) = 6800 \cos\left(\frac{4}{3} \pi t\right) + 6400$$

State the maximum value of  $d(t)$ . State the period of  $d(t)$ . Determine the average rate of change from  $\frac{3}{4} \leq t \leq 2$ .

- 36 Solve algebraically for all values of  $m$ :  $m - 2\sqrt{4m - 3} = 3$
- 37 Xander and Yvette are each practicing for their road tests. Xander decides to drive for 15 minutes the first day and plans to increase the amount of time he spends driving by five minutes each day leading up to the day of his test. Yvette decides to drive for 10 minutes the first day, and she plans to increase the amount of time she spends driving by 15% each day leading up to the day of her test. State whose plan for the amount of time driving per day can be modeled by an arithmetic sequence, and whose plan can be modeled by a geometric sequence. Explain your reasoning. Write an equation for  $x_n$  that represents the amount of time spent driving on the  $n$ th day for Xander's plan and an equation for  $y_n$  that represents the amount of time spent driving on the  $n$ th day for Yvette's plan. Who will spend more time driving on the 19th day of practicing? Justify your answer.

## 0126aii Regents Exam Answer Section

1 ANS: 4

$$27^{6-t} = 9^{t-1}$$

$$(3^3)^{6-t} = (3^2)^{t-1}$$

$$3^{18-3t} = 3^{2t-2}$$

$$18 - 3t = 2t - 2$$

$$20 = 5t$$

$$4 = t$$

PTS: 2

REF: 012601aii

NAT: F.LE.A.4

TOP: Exponential Equations

2 ANS: 2

$$u = x - 4 \quad u^2 - 5u + 6$$

$$(u - 3)(u - 2)$$

$$(x - 4 - 3)(x - 4 - 2)$$

$$(x - 7)(x - 6)$$

PTS: 2

REF: 012602aii

NAT: A.SSE.A.2

TOP: Factoring Polynomials

3 ANS: 3

PTS: 2

REF: 012603ai

NAT: S.IC.B.6

TOP: Analysis of Data

KEY: bias

4 ANS: 2

PTS: 2

REF: 012604aii

NAT: F.IF.C.7

TOP: Graphing Logarithmic Functions

5 ANS: 2

$$a = \frac{3.4 - .4}{2} = 1.5, \quad 12 = \frac{2\pi}{b}, \quad \text{midline} = \frac{3.4 + .4}{2} = 1.9$$

$$b = \frac{\pi}{6}$$

PTS: 2

REF: 012605aii

NAT: F.TF.B.5

TOP: Modeling Trigonometric Functions

6 ANS: 1

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(2)}}{2(3)} = \frac{4 \pm \sqrt{16 - 24}}{6} = \frac{4 \pm \sqrt{-8}}{6} = \frac{4 \pm 2i\sqrt{2}}{6} = \frac{2 \pm i\sqrt{2}}{3}$$

PTS: 2

REF: 012606aii

NAT: A.REI.B.4

TOP: Solving Quadratics

7 ANS: 2

$$\sin\left(\frac{2\pi}{3}\right) = \cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$$

PTS: 2

REF: 012607aii

NAT: F.TF.A.2

TOP: Determining Trigonometric Functions

KEY: radians

8 ANS: 3

$$y = \sqrt[3]{4x+1}$$

$$x = \sqrt[3]{4y+1}$$

$$x^3 = 4y + 1$$

$$x^3 - 1 = 4y$$

$$\frac{x^3 - 1}{4} = y$$

PTS: 2

REF: 012608aai

NAT: F.BF.B.4

TOP: Inverse of Functions

KEY: cubic

9 ANS: 3

normCdf(65,68,64.7,4.267)

PTS: 2

REF: 012609aai

NAT: S.ID.A.4

TOP: Normal Distributions

10 ANS: 2

$$(2+1)^2 + (y-4)^2 = 9$$

$$9 + (y-4)^2 = 9$$

$$(y-4)^2 = 0$$

$$y = 4$$

PTS: 2

REF: 012610aai

NAT: A.REI.C.7

TOP: Quadratic-Linear Systems

11 ANS: 4

$$\text{I. } x^2(36x^2 - 9) = x^2(6x + 3)(6x - 3); \text{ II. } 36\left(x^4 - \frac{x^2}{4}\right) = 36\left(x^2 + \frac{x}{2}\right)\left(x^2 - \frac{x}{2}\right);$$

$$\text{III. } 9(4x^4 - x^2) = 9(2x^2 + x)(2x^2 - x); \text{ IV. } 36x^2\left(x^2 - \frac{1}{4}\right) = 36x^2\left(x - \frac{1}{2}\right)\left(x + \frac{1}{2}\right)$$

PTS: 2

REF: 012611aai

NAT: A.SSE.A.2

TOP: Factoring Polynomials

12 ANS: 3

$$1.0186^{\frac{1}{12}} \approx 1.001537$$

PTS: 2

REF: 012612aai

NAT: A.SSE.B.3

TOP: Modeling Exponential Functions

13 ANS: 1

PTS: 2

REF: 012613aai

NAT: A.APR.B.2

TOP: Remainder and Factor Theorems

14 ANS: 2

$$\frac{\sqrt[3]{a} \cdot \sqrt[5]{a^2}}{\sqrt{a}} = \frac{a^{\frac{1}{3}} \cdot a^{\frac{2}{5}}}{a^{\frac{1}{2}}} = \frac{a^{\frac{10}{30}} \cdot a^{\frac{12}{30}}}{a^{\frac{15}{30}}} = a^{\frac{7}{30}}$$

PTS: 2 REF: 012614aai NAT: N.RN.A.2 TOP: Radicals and Rational Exponents

15 ANS: 1 PTS: 2 REF: 012615aai NAT: A.APR.B.3

TOP: Graphing Polynomial Functions

16 ANS: 4

$$\frac{52}{52+35} \approx .60$$

PTS: 2 REF: 012616aai NAT: S.CP.A.4 TOP: Conditional Probability

17 ANS: 2

$$\begin{array}{r} \phantom{3x-1} \overline{) \phantom{3x^3} - x - 6} \\ 3x-1 \overline{) 3x^3 - 4x^2 - 17x + 6} \\ \underline{3x^3 - x^2} \phantom{+ 6} \\ -3x^2 - 17x \phantom{+ 6} \\ \underline{-3x^2 + x} \phantom{+ 6} \\ -18x + 6 \\ \underline{-18x + 6} \\ 0 \end{array}$$

PTS: 2 REF: 012617aai NAT: A.APR.D.6 TOP: Rational Expressions

KEY: division

18 ANS: 2 PTS: 2 REF: 012618aai NAT: A.REI.B.4

TOP: Solving Quadratics

19 ANS: 1 PTS: 2 REF: 012619aai NAT: F.BF.A.2

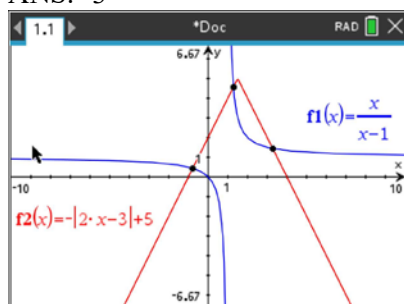
TOP: Sequences KEY: recursive, geometric

20 ANS: 3

The vertical distance from the directrix to the focus,  $p$ , is 6. The vertical distance from the vertex to the focus is half this distance, or 3.  $y = 7 + 3 = 10$

PTS: 2 REF: 012620aai NAT: G.GPE.A.2 TOP: Graphing Quadratic Functions

21 ANS: 3



PTS: 2 REF: 012621aai NAT: A.REI.D.11 TOP: Other Systems  
KEY: rational

22 ANS: 4

$$\tan^2 x + 1 = \sec^2 x \quad \cos x = \pm \frac{1}{\sqrt{7}} \quad \text{Cosine is negative in Quadrant II.}$$

$$(-\sqrt{6})^2 + 1 = \sec^2 x$$

$$7 = \sec^2 x$$

$$\pm\sqrt{7} = \sec x$$

PTS: 2 REF: 012622aai NAT: F.TF.C.8 TOP: Determining Trigonometric Functions

23 ANS: 3

$$S_6 = \frac{400(1 - 1.08^6)}{1 - 1.08} \approx 2934$$

PTS: 2 REF: 012623aai NAT: F.BF.B.7 TOP: Series  
KEY: geometric

24 ANS: 3 PTS: 2 REF: 012624aai NAT: F.LE.B.5  
TOP: Modeling Exponential Functions

25 ANS:

$$2000 = 250(1.8)^t$$

$$8 = 1.8^t$$

$$\log 8 = \log 1.8^t$$

$$\log 8 = t \log 1.8$$

$$\frac{\log 8}{\log 1.8} = t$$

$$3.54 \approx t$$

PTS: 2 REF: 012625aai NAT: F.LE.A.4 TOP: Exponential Growth

26 ANS:

The temperature at 3pm is  $90^\circ$ .

PTS: 2 REF: 012626aai NAT: F.IF.B.4 TOP: Graphing Trigonometric Functions

27 ANS:

$$(-64)^{\frac{2}{3}} = 16$$

$$\left( (-64)^{\frac{1}{3}} \right)^2 = 16$$

$$(-4)^2 = 16$$

$$16 = 16$$

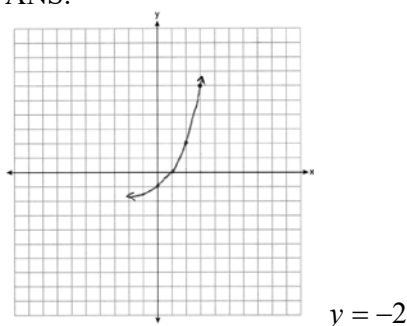
PTS: 2

REF: 012627aii

NAT: N.RN.A.1

TOP: Radicals and Rational Exponents

28 ANS:



PTS: 2

REF: 012628aii

NAT: F.IF.C.7

TOP: Graphing Exponential Functions

29 ANS:

$$58\% + 24\% - 16\% = 66\%$$

PTS: 2

REF: 012629aii

NAT: S.CP.B.7

TOP: Addition Rule

30 ANS:

$$y = 61.14(1.04)^x$$

PTS: 2

REF: 012630aii

NAT: S.ID.B.6

TOP: Regression

KEY: exponential

31 ANS:

$$\frac{24}{x^2 + 4x} + \frac{x}{x + 4} = \frac{5}{x}$$

$$\frac{24}{x^2 + 4x} + \frac{x^2}{x(x + 4)} = \frac{5(x + 4)}{x(x + 4)}$$

$$24 + x^2 = 5x + 20$$

$$x^2 - 5x + 4 = 0$$

$$(x - 1)(x - 4) = 0$$

$$x = 1, 4$$

PTS: 2

REF: 012631aii

NAT: A.REI.A.2

TOP: Solving Rationals

32 ANS:

$$i(x+i) - (x-i)^2 = ix + i^2 - (x^2 - 2ix + i^2) = ix - 1 - x^2 + 2ix + 1 = -x^2 + 3xi$$

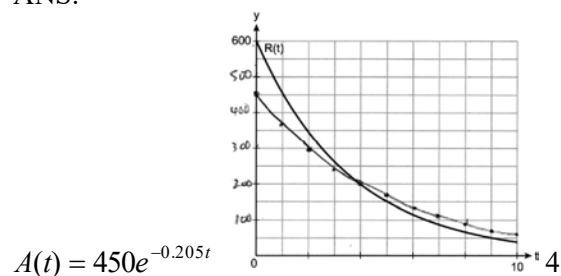
PTS: 2 REF: 012632aai NAT: N.CN.A.2 TOP: Operations with Complex Numbers

33 ANS:

$0.607 \pm 2 \cdot 0.157 \approx 0.293 - 0.921$ . No, since 0.30 falls within the 95% interval.

PTS: 4 REF: 012633aai NAT: S.IC.A.2 TOP: Analysis of Data

34 ANS:



PTS: 4 REF: 012634aai NAT: A.REI.D.11 TOP: Other Systems

KEY: exponential

35 ANS:

$$6800(1) + 6400 = 13,200. \quad \frac{2\pi}{\frac{4}{3}\pi} = 1.5. \quad \frac{d(2) - d\left(\frac{3}{4}\right)}{2 - \frac{3}{4}} = 2,720.$$

PTS: 4 REF: 012635aai NAT: F.IF.B.6 TOP: Rate of Change

KEY: trigonometric

36 ANS:

$$m - 2\sqrt{4m-3} = 3 \quad 1 \text{ is extraneous.}$$

$$m - 3 = 2\sqrt{4m-3}$$

$$m^2 - 6m + 9 = 4(4m-3)$$

$$m^2 - 6m + 9 = 16m - 12$$

$$m^2 - 22m + 21 = 0$$

$$(m-1)(m-21) = 0$$

$$m = 1, 21$$

PTS: 4 REF: 012636aai NAT: A.REI.A.2 TOP: Solving Radicals

37 ANS:

Xander's plan is arithmetic because the time increases by 5 minutes every day. Yvette's plan is geometric because the time increases by 15% every day.  $x_n = 15 + (n - 1)5$ . Yvette, as  $x_{19} = 15 + (19 - 1)5 = 105$

$$y_n = 10(1.15)^{n-1} \qquad y_{19} = 10(1.15)^{19-1} \approx 124$$

PTS: 6

REF: 012637a

NAT: F.BF.A.2

TOP: Sequences

KEY: explicit