

7 May 2018

Name: .

Homework: Exponential functions, imaginary numbers, sequences, logs

1. A bank account earns interest at a continuous interest rate of 5% per year. The initial deposit is \$225.

(a) Express the balance in the account as a function in the form $P(t) = P_0 \cdot e^{rt}$

(b) Convert the function to one without a coefficient in the exponent.

(c) What is the interest rate expressed as a simple, annual rate?

2. Judith puts \$5000 into an investment account with interest compounded continuously. If the annual interest rate is 3.25% what is the balance after 30 years?

3. Lisa puts \$1000 into an investment account with interest compounded continuously. What is the approximate annual rate is needed for the account to grow to \$1529.59 after 10 years?

4. The function below models the average price of gas in a small town since January 1st.

$$G(t) = -0.0049t^4 + 0.0923t^3 - 0.56t^2 + 1.166t + 3.23, \text{ where } 0 \leq t \leq 10.$$

If $G(t)$ is the average price of gas in dollars and t represents the number of months since January 1st, the absolute maximum $G(t)$ reaches over the given domain is about what value, to the nearest cent? (graph the function in your calculator and use the Max function)

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5. Write $\sqrt[3]{x^8}$ as a single term with a rational exponent.
6. Write $\sqrt{a^3} \div a^{\frac{1}{2}}$ as an expression with positive, integer exponents.
7. If $n = \sqrt{z^5}$ and $m = z^{\frac{7}{2}}$, where $a > 0$, express $\frac{n}{m}$ as a radical with positive, integer exponents.
8. What is the expression $5i^3(-2i + 5)$ equivalent to? Express your answer in the form $a + bi$, where $a, b \in \mathbb{R}$.
9. Simplify the expression $(2x - i)^2$, where i is the imaginary unit. Express your answer in the form $a + bi$, where $a, b \in \mathbb{R}$.
10. Algebraically determine the values of h and k to correctly complete the identity stated below.

$$3x^3 - 7x^2 + 5x - 7 = (x - 2)(3x^2 + hx + 3) + k$$

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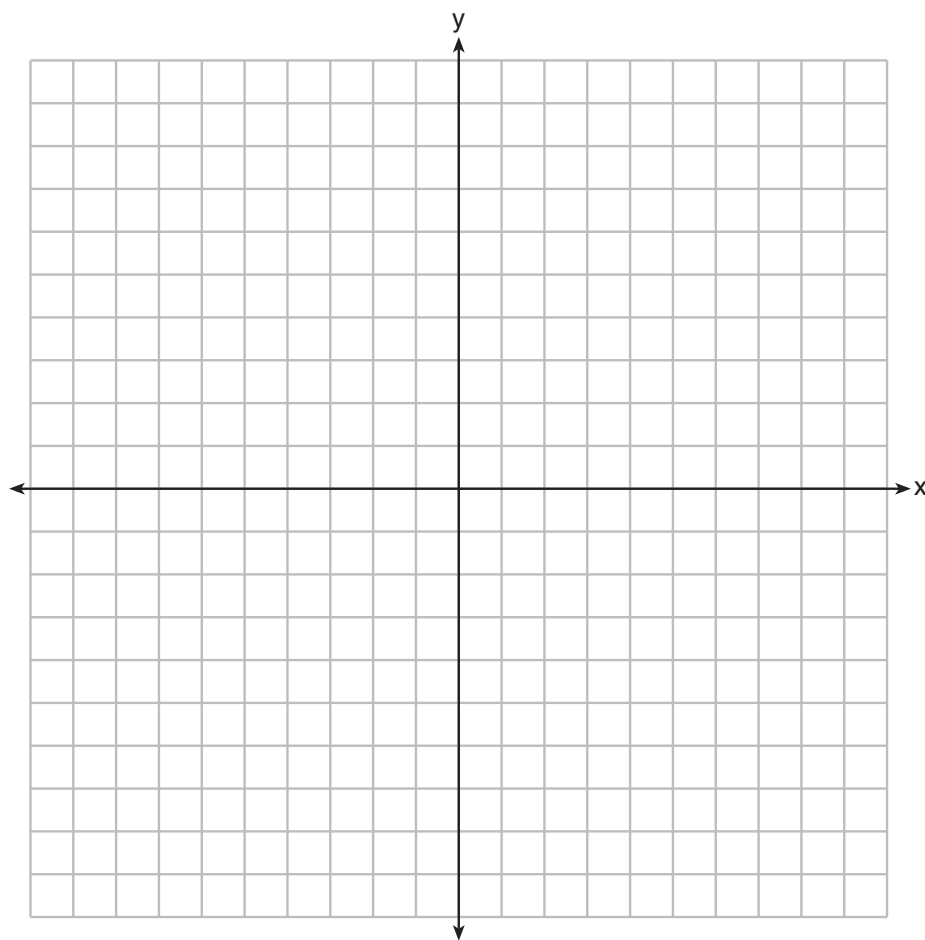
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11. Graph the function $f(x) = x^3 - 4x + 1$.

(a) Write down the y -intercept.

(b) Mark the x -intercepts on the graph as ordered pairs, rounding to the nearest hundredth.

(c) Describe the end behavior of the function. (use language like “As x goes to positive infinity, y goes to...”)



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12. The expression $(x + a)(x + b)$ can not be written as

(a) $a(x + b) + x(x + b)$

(b) $x^2 + (a + b)x + ab$

(c) $x^2 + abx + ab$

(d) $x(x + a) + b(x + a)$

13. In an arithmetic sequence, the first term is 3 and the second term is 7.

(a) Find the common difference.

[2]

(b) Find the tenth term.

[2]

(c) Find the sum of the first ten terms of the sequence.

[2]

14. Consider a geometric sequence where the first term is 768 and the second term is 576.
Find the least value of n such that the n th term of the sequence is less than 7.

[6]

15. Let $x = \ln 7$ and $y = \ln 3$. Write the following expressions in terms of x and y .

(a) $\ln\left(\frac{3}{7}\right)$.

[2]

(b) $\ln 63$.

[4]

16. Let $f(x) = k \log_2 x$.

(a) Given that $f^{-1}(1) = 8$, find the value of k .

[3]

(b) Find $f^{-1}\left(\frac{2}{3}\right)$

[4]