

**DUE: August 9, 2021**

This assignment is for students who have completed Algebra 2 Honors and are taking Advanced Math Honors in the 2021-2022 school year.

Did you read the instructions? \_\_\_\_\_

What math are you taking in the 2021-2022 school year? \_\_\_\_\_

The expectation of the Math Department at Archbishop Hannan High School is that its students become Tenacious Problem Solvers! Thus, as you work on these problems be sure and document your strategies, your mathematical explanations, any drawings, tables or graphs that you use, and the best, complete answer you can find. We hope that you are challenged by these problems and enjoy them. We look forward to the discussion of these problems that we will have in the first weeks of school. Come prepared to defend your solution!

1. At noon one day, Corey decided to follow a straight course in a motor boat. After one hour of making no turns and traveling at a steady rate, the boat was 6 miles east and 8 miles north of its point of departure. What was Corey's position at two o'clock? How far had Corey traveled? What was Corey's speed?

2. (Continuation) Assume that the fuel tank initially held 12 gallons, and that the boat gets 4 miles to the gallon. How far did Corey get before running out of fuel? When did this happen? When radioing the Coast Guard for help, how should Corey describe the boat's position?

3. A lattice point is a point whose coordinates are integers. Find two lattice points that are exactly  $\sqrt{13}$  units apart. Is it possible to find lattice points that are  $\sqrt{15}$  units apart? Is it possible to form a square whose area is 18 by connecting four lattice points? Explain.

4. A 9-by-12 rectangular picture is framed by a border of uniform width. Given that the combined area of picture plus frame is 180 square units, find the width of the border.

5. Explain why you cannot take the log of a negative argument (that has no variables). Be specific with your terminology. Then explain why you CAN take the log with a negative argument that does contain a variable.

## Essential Skills

The following problems represent the essential skills you need to be successful in Honors Advanced Math.

### USING PASCAL'S TRIANGLE:

Find each coefficient described.

1) Coefficient of  $y^2x$  in expansion of  $(y + x)^3$

Find each term described.

2) 3rd term in expansion of  $(v + u)^3$

Expand completely.

3)  $(u + v)^4$

### Long Divide:

Write your answer as polynomial with remainder if necessary.

4)  $(7x^5 - 21x^4 + 9x^3 - 21x^2 - 24x + 21) \div (x - 3)$

5)  $y = 3x^3 - x^2 + 27x - 9 \div 3x - 1$

State lead coefficient and degree. State end behavior. Find roots by factoring.

6)  $y = 3x^4 - 46x^2 - 32$

7)  $y = x^5 + x^4 - 29x^3 - 29x^2 + 100x + 100$   
(Factor by grouping-then factor those factors if necessary.)

**State lead coefficient, degree and end behavior.**

8)  $y = x^3(5 - x)^3 \cdot (2x + 1)^2$

9)  $y = -3(5x - 2)^2 \cdot (x + 7)^3$

**Solve each equation. Give answer as integer or fraction.**

10)  $2^{b-1} \cdot 2^{-b} = 64$

11)  $27 \cdot 27^{2n} = 81^{2n}$

**Solve each equation. Round your answers to the nearest ten-thousandth.**

12)  $15^{a+10} - 5 = 95$

13)  $-9e^{4n+1} + 3 = -64$

**Find the balance. Round to the nearest cent.**

14) Mary invests \$6,277 in a retirement account with a fixed annual interest rate of 8% compounded continuously. What will the account balance be after 18 years?

15) Ted invests \$4,117 in a savings account with a fixed annual interest rate of 2% compounded 3 times per year. What will the account balance be after 4 years?

**Find the inverse of each function.**

16)  $f(x) = (x - 1)^3 + 2$

17)  $f(x) = -5x - 5$

**Solve each equation.**

18)  $\log(-70 + 2b^2) = \log(3b^2 - 17b)$

19)  $2\log_9 9n = -2$

20)  $\log_7 x + \log_7 (x + 6) = 1$

21)  $\log_5 8 + \log_5 -4x = 2$

**Find the inverse of each function.**

22)  $y = -3 \log_6 x$

23)  $y = 6^{\frac{x}{3}}$