MeTEOR Performance Task
Algebra II

Mathematics
Volume of the Co ee Mug Container

Performance Task Item: Volume of the Coffee Mug Container

Task/Question 1:

A. In what order should you arrange the terms when you divide polynomials?

B. How do you determine where to place the first term in the quotient?

C. How do you know when you are finished dividing a polynomial?

D. Divide each using long division:

$(x^2 - 3x - 40) \div (x + 5)$

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$(3x^2 + 7x - 20) \div (x + 4)$

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$(x^3 + 3x^2 - x + 2) \div (x - 1)$

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

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E. Scientists have found that not all eyes are spherical on animals. Variations in the structure of the eye have happened throughout evolutionary history. Pupils also come in various types, depending on the purpose it may hold for the animal that contains it. Those who need to be active during all times of day and night are better equipped with pupils which can easily adjust, such as the rectangular eye**.** Sheep, Goats, Octopuses and Toads have these rectangular shaped pupils.

If the area of a goat's pupil is $(x^3 - x^2 - 4x + 4)$ and one of its side lengths is $(x - 2)$, what is the other dimension of the pupil?

Task/Question 2:

A. Why would one choose long division over synthetic division when dividing polynomials?

B. Define the Remainder Theorem:

C. Use synthetic division and the Remainder Theorem to find P(x):

$P(x) = x^3 + 4x^2 - 8x - 6$; $a = -2$ $P(x) = 2x^4 + 6x^3 + 5x^2 - 45$; $a = -3$

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D. When a polynomial is divided by $(x + 4)$, the quotient is $(2x + 3)$ with a remainder of 2. Find the polynomial.

E. Explain how you got your answer in Part D:

Task/Question 3:

The total number of visitors who went to Tropic's Theme Park from December 1 to December 10 can be modeled by the function $F(x) = 126x^3+279x^2+90x+450$.

The number of shows played at the theme park from December 1 to December 10 can be modeled by $G(x) = 18x + 45$, where x is the number of days since December 1.

A. Write the expression that describes the average number of visitors per show?

B. If $x = 7$, what is the average number of visitors per show?

C. Tropic's Theme Park decides to promote the shows to get an average of 500 people per show. What is the minimum value that x can be in order to have at least 500 per show?

D. If your expression in Part A had a remainder of 58, what would the original function F(x) have been?

E. Explain how you determined the answer to Part D and how it would affect the minimum value in Part C. Justify and defend how your approach to solving this is the **most efficient**.

Task/Question 4:

Betty's Coffee Shop sells coffee mugs in her coffee shop. Each mug comes in a box for safe keeping. The polynomial ($x^3 + 5x^2 – 9x -45$) expresses the volume, in cubic inches, of a box used to hold the coffee mug. The height of the box is ($x + 5$).

A. What are the other dimensions of the box?

B. Customers like the mugs so much that Betty has started selling them by the carton for offices to hand out as gifts. The carton needed to fill this request only comes in one size. The dimensions of the carton are double the dimensions of the coffee mugs box. What are the dimensions of the carton?

C. What is the volume of the carton in Part B?

D. How many mugs fit in the carton from Part C?

E. Explain how you determined the answer to Part D. Justify and defend how your approach to solving this is the **most efficient**.