1. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 7x^4 + 7x^3 + 4x^2 + 5x + 5$$

A. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 5}$

B. $\pm 1, \pm 5$

C. $\pm 1, \pm 7$

D. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 7}$

E. There is no formula or theorem that tells us all possible Integer roots.

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2. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^3 - 91x^2 + 175x - 100$$

A. $z_1 \in [-5.2, -4.3]$, $z_2 \in [-1.11, -0.74]$, and $z_3 \in [-0.75, -0.75]$

B. $z_1 \in [1.2, 1.7]$, $z_2 \in [1, 1.43]$, and $z_3 \in [4.9, 5.23]$

C. $z_1 \in [-5.2, -4.3]$, $z_2 \in [-4.01, -3.75]$, and $z_3 \in [-0.62, -0.18]$

D. $z_1 \in [-0.4, 0.9]$, $z_2 \in [0.2, 1.17]$, and $z_3 \in [4.9, 5.23]$

E. $z_1 \in [-5.2, -4.3]$, $z_2 \in [-1.61, -0.86]$, and $z_3 \in [-1.25, -1.23]$

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3. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 5x^2 + 3x + 3$$

A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 3}$

B. $\pm 1, \pm 5$

C. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 5}$

D. $\pm 1, \pm 3$

E. There is no formula or theorem that tells us all possible Rational roots.

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4. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 + 52x^2 + 32x - 66}{x + 4}$$

A. $a \in [9, 14], \; b \in [12, 16], \; c \in [-18, -6], \text{ and } r \in [-2, 3].$

B. $a \in [9, 14], \; b \in [92, 100], \; c \in [398, 401], \text{ and } r \in [1528, 1540].$

C. $a \in [-42, -38], \; b \in [-108, -107], \; c \in [-405, -395], \text{ and } r \in [-1671, -1663].$

D. $a \in [-42, -38], \; b \in [209, 213], \; c \in [-819, -815], \text{ and } r \in [3192, 3199].$

E. $a \in [9, 14], \; b \in [-2, 8], \; c \in [18, 27], \text{ and } r \in [-179, -173].$

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5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{10x^3 + 32x^2 - 82x + 35}{x + 5}$$

A. $a \in [-55, -47], \; b \in [-218, -211], \; c \in [-1175, -1170], \text{ and } r \in [-5827, -5821].$

B. $a \in [-55, -47], \; b \in [279, 286], \; c \in [-1493, -1489], \text{ and } r \in [7489, 7500].$

C. $a \in [6, 15], \; b \in [-30, -26], \; c \in [86, 90], \text{ and } r \in [-486, -477].$

D. $a \in [6, 15], \; b \in [-24, -15], \; c \in [3, 9], \text{ and } r \in [-5, 0].$

E. $a \in [6, 15], \; b \in [76, 84], \; c \in [324, 329], \text{ and } r \in [1672, 1677].$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{9x^3 - 28x - 18}{x - 2}$$

A. $a \in [9, 10], b \in [-18, -16], c \in [6, 11]$, and $r \in [-34.2, -29.9]$.

B. $a \in [17, 24], b \in [-43, -33], c \in [38, 45]$, and $r \in [-107.2, -102.2]$.

C. $a \in [9, 10], b \in [3, 15], c \in [-26, -13]$, and $r \in [-37.9, -35]$.

D. $a \in [17, 24], b \in [36, 38], c \in [38, 45]$, and $r \in [69.9, 71.4]$.

E. $a \in [9, 10], b \in [17, 22], c \in [6, 11]$, and $r \in [-2.6, -1.3]$.

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7. Factor the polynomial below completely, knowing that $x + 4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^4 + 14x^3 - 83x^2 - 14x + 120$$

A. $z_1 \in [-3, -0.6]$, $z_2 \in [-1.62, -1.35]$, $z_3 \in [1.21, 1.39]$, and $z_4 \in [2.8, 4.7]$

B. $z_1 \in [-3, -0.6]$, $z_2 \in [-0.73, -0.57]$, $z_3 \in [0.78, 0.81]$, and $z_4 \in [2.8, 4.7]$

C. $z_1 \in [-4.6, -2.8]$, $z_2 \in [-0.87, -0.74]$, $z_3 \in [0.64, 0.74]$, and $z_4 \in [1.8, 2.8]$

D. $z_1 \in [-4.6, -2.8]$, $z_2 \in [-1.28, -1.19]$, $z_3 \in [1.48, 1.52]$, and $z_4 \in [1.8, 2.8]$

E. $z_1 \in [-3, -0.6]$, $z_2 \in [-0.39, -0.3]$, $z_3 \in [3.73, 4.05]$, and $z_4 \in [4.6, 6]$

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8. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^3 - 34x^2 + 45x - 18$$

A. $z_1 \in [0.68, 0.8]$, $z_2 \in [1.41, 1.55]$, and $z_3 \in [1.94, 2.03]$

B. $z_1 \in [-3.08, -2.88]$, $z_2 \in [-2.06, -1.89]$, and $z_3 \in [-0.54, -0.29]$

C. $z_1 \in [-2.18, -1.77]$, $z_2 \in [-1.57, -1.45]$, and $z_3 \in [-0.85, -0.67]$

D. $z_1 \in [0.37, 0.71]$, $z_2 \in [1.31, 1.47]$, and $z_3 \in [1.94, 2.03]$

E. $z_1 \in [-2.18, -1.77]$, $z_2 \in [-1.42, -1.29]$, and $z_3 \in [-0.7, -0.66]$

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{6x^3 + 21x^2 - 31}{x + 3}$$

A. $a \in [4, 9], b \in [38, 48], c \in [110, 119]$, and $r \in [316, 323]$.

B. $a \in [4, 9], b \in [-3, -1], c \in [11, 14]$, and $r \in [-84, -77]$.

C. $a \in [4, 9], b \in [-2, 5], c \in [-11, -7]$, and $r \in [-4, 1]$.

D. $a \in [-21, -16], b \in [-35, -27], c \in [-99, -97]$, and $r \in [-329, -318]$.

E. $a \in [-21, -16], b \in [74, 80], c \in [-228, -223]$, and $r \in [641, 648]$.

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10. Factor the polynomial below completely, knowing that $x + 3$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^4 + 2x^3 - 147x^2 - 288x - 135$$

A. $z_1 \in [-3, -2]$, $z_2 \in [-1.37, -1.31], z_3 \in [-0.72, -0.47]$, and $z_4 \in [4.05, 5.38]$

B. $z_1 \in [-3, -2]$, $z_2 \in [-1.5, -1.47], z_3 \in [-0.87, -0.68]$, and $z_4 \in [4.05, 5.38]$

C. $z_1 \in [-5, -4]$, $z_2 \in [0.36, 0.4], z_3 \in [2.73, 3.27]$, and $z_4 \in [2.23, 3.99]$

D. $z_1 \in [-5, -4]$, $z_2 \in [0.65, 0.68], z_3 \in [1, 1.4]$, and $z_4 \in [2.23, 3.99]$

E. $z_1 \in [-5, -4]$, $z_2 \in [0.75, 0.77], z_3 \in [1.42, 1.72]$, and $z_4 \in [2.23, 3.99]$
