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

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

A. $\pm 1, \pm 3$

B. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2}$

C. $\pm 1, \pm 2$

D. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 3}$

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.*

$$f(x) = 10x^3 - 11x^2 - 106x - 40$$

A. $z_1 \in [-2.5, -0.5]$, $z_2 \in [-0.49, -0.31]$, and $z_3 \in [2.6, 4.9]$

B. $z_1 \in [-6, -3]$, $z_2 \in [0.21, 0.47]$, and $z_3 \in [0.9, 2.8]$

C. $z_1 \in [-6, -3]$, $z_2 \in [0.21, 0.47]$, and $z_3 \in [0.9, 2.8]$

D. $z_1 \in [-2.5, -0.5]$, $z_2 \in [-0.49, -0.31]$, and $z_3 \in [2.6, 4.9]$

E. $z_1 \in [-6, -3]$, $z_2 \in [0, 0.2]$, and $z_3 \in [4.4, 5.1]$

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

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

A. $\pm 1, \pm 2, \pm 4$

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 7}$

C. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 4}$

D. $\pm 1, \pm 7$

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 $r$.

$$\frac{4x^3 + 10x^2 - 18x - 41}{x + 3}$$

A. $a \in [-16, -10], \ b \in [43, 47], \ c \in [-158, -153], \text{ and } r \in [424, 434].$

B. $a \in [2, 5], \ b \in [-4, 2], \ c \in [-15, -7], \text{ and } r \in [-8, -1].$

C. $a \in [2, 5], \ b \in [-13, -3], \ c \in [5, 12], \text{ and } r \in [-68, -64].$

D. $a \in [-16, -10], \ b \in [-27, -18], \ c \in [-97, -90], \text{ and } r \in [-331, -326].$

E. $a \in [2, 5], \ b \in [21, 25], \ c \in [48, 51], \text{ and } r \in [103, 109].$

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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 $r$.

$$\frac{25x^3 - 25x^2 - 125x - 72}{x - 3}$$

A. $a \in [21, 30], \ b \in [-103, -97], \ c \in [170, 177], \text{ and } r \in [-597, -595].$

B. $a \in [72, 79], \ b \in [-252, -246], \ c \in [622, 630], \text{ and } r \in [-1949, -1943].$

C. $a \in [72, 79], \ b \in [199, 204], \ c \in [470, 477], \text{ and } r \in [1347, 1356].$

D. $a \in [21, 30], \ b \in [19, 30], \ c \in [-76, -74], \text{ and } r \in [-224, -221].$

E. $a \in [21, 30], \ b \in [47, 55], \ c \in [24, 27], \text{ and } r \in [1, 7].$

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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 $r$.

$$\frac{15x^3 + 65x^2 - 82}{x + 4}$$

A. $a \in [-61, -54], b \in [305, 306], c \in [-1229, -1212]$, and $r \in [4794, 4805]$.

B. $a \in [10, 19], b \in [-10, -5], c \in [46, 54]$, and $r \in [-334, -325]$.

C. $a \in [10, 19], b \in [3, 7], c \in [-22, -17]$, and $r \in [-3, -1]$.

D. $a \in [-61, -54], b \in [-181, -171], c \in [-705, -698]$, and $r \in [-2885, -2879]$.

E. $a \in [10, 19], b \in [121, 130], c \in [500, 507]$, and $r \in [1913, 1921]$.

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7. 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.*

$$f(x) = 10x^4 + 77x^3 + 157x^2 - 144$$

A. $z_1 \in [-4.47, -3.95]$, $z_2 \in [-3.43, -1.5], z_3 \in [-2.16, -1.33]$, and $z_4 \in [0.55, 0.98]$

B. $z_1 \in [-0.43, -0.27]$, $z_2 \in [2.29, 3.4], z_3 \in [2.32, 3.36]$, and $z_4 \in [3.5, 4.38]$

C. $z_1 \in [-1.37, -1.06]$, $z_2 \in [0.46, 0.91], z_3 \in [2.32, 3.36]$, and $z_4 \in [3.5, 4.38]$

D. $z_1 \in [-0.85, -0.49]$, $z_2 \in [1.26, 1.77], z_3 \in [2.32, 3.36]$, and $z_4 \in [3.5, 4.38]$

E. $z_1 \in [-4.47, -3.95]$, $z_2 \in [-3.43, -1.5], z_3 \in [-1.04, -0.04]$, and $z_4 \in [1.01, 2.3]$

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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.*

$$f(x) = 25x^3 - 95x^2 - 26x + 24$$

A. $z_1 \in [-5.8, -2.8]$, $z_2 \in [-0.61, -0.32]$, and $z_3 \in [0.3, 1.4]$

B. $z_1 \in [-5.8, -2.8]$, $z_2 \in [-2.15, -1.87]$, and $z_3 \in [0, 0.5]$

C. $z_1 \in [-1.9, -0.8]$, $z_2 \in [2.17, 2.85]$, and $z_3 \in [2.9, 5]$

D. $z_1 \in [-5.8, -2.8]$, $z_2 \in [-2.88, -2.26]$, and $z_3 \in [1.5, 2.3]$

E. $z_1 \in [-1, 1]$, $z_2 \in [-0.28, 0.53]$, and $z_3 \in [2.9, 5]$

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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 $r$.

$$\frac{16x^3 - 84x^2 + 102}{x - 5}$$

A. $a \in [79, 82], b \in [-485, -478], c \in [2415, 2426]$, and $r \in [-11998, -11992]$.

B. $a \in [79, 82], b \in [312, 321], c \in [1576, 1582]$, and $r \in [8002, 8007]$.

C. $a \in [14, 20], b \in [-22, -19], c \in [-84, -79]$, and $r \in [-219, -214]$.

D. $a \in [14, 20], b \in [-166, -162], c \in [818, 822]$, and $r \in [-4008, -3996]$.

E. $a \in [14, 20], b \in [-7, -2], c \in [-23, -17]$, and $r \in [-6, 5]$.

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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.*

$$f(x) = 25x^4 + 5x^3 - 231x^2 - 45x + 54$$

A. $z_1 \in [-4, 1]$, $z_2 \in [-0.51, -0.34], z_3 \in [0.48, 0.82]$, and $z_4 \in [-2, 7]$

B. $z_1 \in [-4, 1]$, $z_2 \in [-2.54, -2.36], z_3 \in [1.66, 1.68]$, and $z_4 \in [-2, 7]$

C. $z_1 \in [-4, 1]$, $z_2 \in [-0.38, 0.25], z_3 \in [2.84, 3.14]$, and $z_4 \in [-2, 7]$

D. $z_1 \in [-4, 1]$, $z_2 \in [-1.84, -1.58], z_3 \in [2.45, 2.54]$, and $z_4 \in [-2, 7]$

E. $z_1 \in [-4, 1]$, $z_2 \in [-0.72, -0.47], z_3 \in [0.36, 0.52]$, and $z_4 \in [-2, 7]$

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