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

$$\frac{9x^3 - 27x + 23}{x + 2}$$

A. $a \in [6, 15], b \in [14, 26], c \in [6, 13]$, and $r \in [39, 43]$.

B. $a \in [6, 15], b \in [-32, -26], c \in [50, 62]$, and $r \in [-139, -137]$.

C. $a \in [-20, -13], b \in [-37, -32], c \in [-104, -98]$, and $r \in [-175, -173]$.

D. $a \in [-20, -13], b \in [36, 39], c \in [-104, -98]$, and $r \in [220, 223]$.

E. $a \in [6, 15], b \in [-18, -9], c \in [6, 13]$, and $r \in [0, 9]$.

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

$$f(x) = 5x^3 + 3x^2 + 6x + 3$$

A. $\pm 1, \pm 3$

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

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

D. $\pm 1, \pm 5$

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

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

$$\frac{6x^3 + 21x^2 - 30}{x + 3}$$

A. $a \in [-18, -14], b \in [-33, -30], c \in [-99, -97]$, and $r \in [-327, -324]$.

B. $a \in [-1, 8], b \in [37, 44], c \in [116, 120]$, and $r \in [321, 324]$.

C. $a \in [-18, -14], b \in [73, 78], c \in [-226, -223]$, and $r \in [641, 647]$.

D. $a \in [-1, 8], b \in [-6, 1], c \in [10, 13]$, and $r \in [-79, -73]$.

E. $a \in [-1, 8], b \in [-1, 10], c \in [-14, -6]$, and $r \in [-7, -1]$.

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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.

$$\frac{20x^3 - 107x^2 + 117x - 34}{x - 4}$$

A. $a \in [20, 23]$, $b \in [-30, -25]$, $c \in [7, 10]$, and $r \in [-1, 7]$.

B. $a \in [20, 23]$, $b \in [-187, -185]$, $c \in [863, 866]$, and $r \in [-3499, -3493]$.

C. $a \in [75, 84]$, $b \in [-430, -426]$, $c \in [1821, 1828]$, and $r \in [-7334, -7328]$.

D. $a \in [20, 23]$, $b \in [-52, -46]$, $c \in [-24, -22]$, and $r \in [-108, -96]$.

E. $a \in [75, 84]$, $b \in [206, 220]$, $c \in [966, 972]$, and $r \in [3841, 3844]$.

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

$$f(x) = 4x^4 + 2x^3 + 7x^2 + 6x + 3$$

A. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 4}$

B. $\pm 1, \pm 3$

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

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 3}$

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

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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.

$$\frac{20x^3 - 54x^2 - 96x - 36}{x - 4}$$

A. $a \in [17, 23]$, $b \in [-136, -127]$, $c \in [436, 441]$, and $r \in [-1798, -1793]$.

B. $a \in [80, 83]$, $b \in [261, 270]$, $c \in [967, 969]$, and $r \in [3833, 3837]$.

C. $a \in [17, 23]$, $b \in [26, 29]$, $c \in [5, 9]$, and $r \in [-4, -2]$.

D. $a \in [17, 23]$, $b \in [4, 12]$, $c \in [-81, -75]$, and $r \in [-271, -268]$.

E. $a \in [80, 83]$, $b \in [-375, -370]$, $c \in [1397, 1403]$, and $r \in [-5638, -5635]$.

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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.*

$$f(x) = 20x^4 + 103x^3 - 4x^2 - 339x + 180$$

A. $z_1 \in [-2.04, -1.58]$, $z_2 \in [-0.86, -0.8]$, $z_3 \in [2.92, 3.3]$, and $z_4 \in [3.77, 4.03]$

B. $z_1 \in [-3.47, -2.82]$, $z_2 \in [-0.46, -0.21]$, $z_3 \in [2.92, 3.3]$, and $z_4 \in [3.77, 4.03]$

C. $z_1 \in [-4.67, -3.71]$, $z_2 \in [-3.23, -2.91]$, $z_3 \in [0.5, 0.64]$, and $z_4 \in [0.85, 1.29]$

D. $z_1 \in [-4.67, -3.71]$, $z_2 \in [-3.23, -2.91]$, $z_3 \in [0.68, 1.09]$, and $z_4 \in [1.31, 1.72]$

E. $z_1 \in [-1.44, -0.82]$, $z_2 \in [-0.79, -0.4]$, $z_3 \in [2.92, 3.3]$, and $z_4 \in [3.77, 4.03]$

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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.*

$$f(x) = 8x^3 - 10x^2 - 57x + 45$$

A. $z_1 \in [-3.07, -2.72]$, $z_2 \in [-0.86, -0.71]$, and $z_3 \in [2.34, 2.68]$

B. $z_1 \in [-3.07, -2.72]$, $z_2 \in [-1.55, -1.2]$, and $z_3 \in [-0.03, 0.76]$

C. $z_1 \in [-0.52, -0.05]$, $z_2 \in [1.01, 1.41]$, and $z_3 \in [2.8, 3.19]$

D. $z_1 \in [-2.84, -2.33]$, $z_2 \in [0.4, 0.87]$, and $z_3 \in [2.8, 3.19]$

E. $z_1 \in [-3.07, -2.72]$, $z_2 \in [-0.63, -0.18]$, and $z_3 \in [4.83, 5.39]$

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9. Factor the polynomial below completely, knowing that $x-5$ 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.*

$$f(x) = 12x^4 - 5x^3 - 325x^2 + 125x + 625$$

A. $z_1 \in [-5, -4]$, $z_2 \in [-1.25, -1.18]$, $z_3 \in [1.62, 1.74]$, and $z_4 \in [5, 9]$

B. $z_1 \in [-5, -4]$, $z_2 \in [-1.69, -1.55]$, $z_3 \in [1.17, 1.47]$, and $z_4 \in [5, 9]$

C. $z_1 \in [-5, -4]$, $z_2 \in [-0.57, -0.41]$, $z_3 \in [4.99, 5.11]$, and $z_4 \in [5, 9]$

D. $z_1 \in [-5, -4]$, $z_2 \in [-0.74, -0.58]$, $z_3 \in [0.76, 0.81]$, and $z_4 \in [5, 9]$

E. $z_1 \in [-5, -4]$, $z_2 \in [-0.94, -0.76]$, $z_3 \in [0.49, 0.62]$, and $z_4 \in [5, 9]$

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10. 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.*

$$f(x) = 10x^3 + 39x^2 + 18x - 27$$

A. $z_1 \in [-1.67, -0.67]$, $z_2 \in [0.52, 0.82]$, and $z_3 \in [2, 3.2]$

B. $z_1 \in [-3, -2]$, $z_2 \in [0.04, 0.48]$, and $z_3 \in [2, 3.2]$

C. $z_1 \in [-3, -2]$, $z_2 \in [-0.8, -0.48]$, and $z_3 \in [1.3, 1.7]$

D. $z_1 \in [-3, -2]$, $z_2 \in [-1.53, -1.4]$, and $z_3 \in [0, 0.7]$

E. $z_1 \in [-0.6, 1.4]$, $z_2 \in [1.33, 1.63]$, and $z_3 \in [2, 3.2]$
