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

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

A. $\pm 1, \pm 5$

B. $\pm 1, \pm 3$

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

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

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

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

$$\frac{16x^3 - 48x - 27}{x - 2}$$

A. $a \in [30, 35], b \in [-72, -60], c \in [76, 81],$ and $r \in [-189, -180]$.

B. $a \in [8, 23], b \in [-35, -31], c \in [11, 21],$ and $r \in [-61, -55]$.

C. $a \in [8, 23], b \in [13, 20], c \in [-38, -31],$ and $r \in [-61, -55]$.

D. $a \in [30, 35], b \in [62, 69], c \in [76, 81],$ and $r \in [132, 139]$.

E. $a \in [8, 23], b \in [30, 37], c \in [11, 21],$ and $r \in [4, 10]$.

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

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

A. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 3, \pm 6}$

B. $\pm 1, \pm 2, \pm 3, \pm 6$

C. $\pm 1, \pm 3$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 3}$

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

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4. 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. $z_1 \in [-5, -2],\ z_2 \in [-0.73, -0.38],$ and $z_3 \in [1.5, 1.9]$

B. $z_1 \in [-2.67, -0.67],\ z_2 \in [0.59, 1.01],$ and $z_3 \in [2.8, 3.6]$

C. $z_1 \in [-5, -2],\ z_2 \in [-0.6, -0.03],$ and $z_3 \in [2.8, 3.6]$

D. $z_1 \in [-5, -2],\ z_2 \in [-1.87, -0.88],$ and $z_3 \in [-0.4, 0.8]$

E. $z_1 \in [-0.6, 3.4],\ z_2 \in [1.3, 2],$ and $z_3 \in [2.8, 3.6]$

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5. Factor the polynomial below completely, knowing that $x+2$ 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.*

$$f(x) = 20x^4 - 13x^3 - 95x^2 + 52x + 60$$

A. $z_1 \in [-3, 1],\ z_2 \in [-1.92, -1.65], z_3 \in [0.77, 0.97],$ and $z_4 \in [1.36, 2.38]$

B. $z_1 \in [-3, 1],\ z_2 \in [-0.88, -0.66], z_3 \in [1.61, 1.84],$ and $z_4 \in [1.36, 2.38]$

C. $z_1 \in [-3, 1],\ z_2 \in [-0.76, -0.57], z_3 \in [1.23, 1.3],$ and $z_4 \in [1.36, 2.38]$

D. $z_1 \in [-3, 1],\ z_2 \in [-0.51, 0.03], z_3 \in [1.9, 2.15],$ and $z_4 \in [2.48, 3.24]$

E. $z_1 \in [-3, 1],\ z_2 \in [-1.52, -1.08], z_3 \in [0.55, 0.78],$ and $z_4 \in [1.36, 2.38]$

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6. 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.*

$$f(x) = 6x^3 - 1x^2 - 20x + 12$$

A. $z_1 \in [-2.57, -1.94],\ z_2 \in [0.56, 0.71],$ and $z_3 \in [0.6, 1.7]$

B. $z_1 \in [-1.52, -1.02]$, $z_2 \in [-0.93, -0.52]$, and $z_3 \in [1.9, 2.4]$

C. $z_1 \in [-3.42, -2.64]$, $z_2 \in [-0.49, -0.3]$, and $z_3 \in [1.9, 2.4]$

D. $z_1 \in [-1.52, -1.02]$, $z_2 \in [-0.93, -0.52]$, and $z_3 \in [1.9, 2.4]$

E. $z_1 \in [-2.57, -1.94]$, $z_2 \in [0.56, 0.71]$, and $z_3 \in [0.6, 1.7]$

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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.*

$$f(x) = 15x^4 + 91x^3 + 5x^2 - 339x + 180$$

A. $z_1 \in [-5.54, -4.92]$, $z_2 \in [-3.08, -2.8]$, $z_3 \in [0.68, 1.11]$, and $z_4 \in [1.64, 2.04]$

B. $z_1 \in [-2.18, -1.46]$, $z_2 \in [-1.31, -0.71]$, $z_3 \in [2.89, 3.23]$, and $z_4 \in [4.76, 5.58]$

C. $z_1 \in [-1.53, -0.97]$, $z_2 \in [-0.73, -0.5]$, $z_3 \in [2.89, 3.23]$, and $z_4 \in [4.76, 5.58]$

D. $z_1 \in [-4.14, -3.6]$, $z_2 \in [-0.46, -0.15]$, $z_3 \in [2.89, 3.23]$, and $z_4 \in [4.76, 5.58]$

E. $z_1 \in [-5.54, -4.92]$, $z_2 \in [-3.08, -2.8]$, $z_3 \in [0.43, 0.7]$, and $z_4 \in [1.28, 1.53]$

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

$$\frac{20x^3 + 20x^2 - 100x + 63}{x + 3}$$

A. $a \in [-63, -57]$, $b \in [-163, -156]$, $c \in [-581, -579]$, and $r \in [-1678, -1673]$.

B. $a \in [20, 25]$, $b \in [-63, -59]$, $c \in [139, 145]$, and $r \in [-504, -495]$.

C. $a \in [20, 25]$, $b \in [-43, -35]$, $c \in [19, 27]$, and $r \in [-1, 7]$.

D. $a \in [-63, -57],\ b \in [199, 206],\ c \in [-701, -696],$ and $r \in [2162, 2167]$.

E. $a \in [20, 25],\ b \in [76, 82],\ c \in [139, 145],$ and $r \in [478, 484]$.

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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.

$$\frac{25x^3 + 105x^2 - 83}{x + 4}$$

A. $a \in [-101, -97], b \in [-296, -291], c \in [-1183, -1175],$ and $r \in [-4809, -4802]$.

B. $a \in [20, 26], b \in [-23, -18], c \in [91, 105],$ and $r \in [-583, -581]$.

C. $a \in [20, 26], b \in [201, 211], c \in [818, 824],$ and $r \in [3193, 3205]$.

D. $a \in [20, 26], b \in [-1, 8], c \in [-20, -15],$ and $r \in [-10, -1]$.

E. $a \in [-101, -97], b \in [500, 508], c \in [-2025, -2019],$ and $r \in [7995, 8006]$.

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

$$\frac{8x^3 + 22x^2 - 80x + 47}{x + 5}$$

A. $a \in [3, 13],\ b \in [61, 63],\ c \in [229, 232],$ and $r \in [1191, 1201]$.

B. $a \in [3, 13],\ b \in [-31, -23],\ c \in [74, 80],$ and $r \in [-410, -405]$.

C. $a \in [-41, -34],\ b \in [216, 223],\ c \in [-1191, -1187],$ and $r \in [5991, 5998]$.

D. $a \in [3, 13],\ b \in [-23, -16],\ c \in [10, 13],$ and $r \in [-5, 0]$.

E. $a \in [-41, -34],\ b \in [-182, -177],\ c \in [-971, -963],$ and $r \in [-4807, -4797]$.
