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

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

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

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

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

D. $\pm 1, \pm 3$

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.

$$\frac{15x^3 - 45x - 26}{x - 2}$$

A. $a \in [30, 34], b \in [-63, -55], c \in [73, 80],$ and $r \in [-181, -171]$.

B. $a \in [15, 18], b \in [-34, -25], c \in [13, 20],$ and $r \in [-59, -52]$.

C. $a \in [30, 34], b \in [59, 61], c \in [73, 80],$ and $r \in [122, 126]$.

D. $a \in [15, 18], b \in [15, 18], c \in [-34, -25],$ and $r \in [-59, -52]$.

E. $a \in [15, 18], b \in [27, 34], c \in [13, 20],$ and $r \in [3, 8]$.

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

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

A. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 3}$

B. $\pm 1, \pm 7$

C. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 7}$

D. $\pm 1, \pm 3$

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

$$f(x) = 8x^3 - 34x^2 - 7x + 60$$

A. $z_1 \in [-1.74, -1.13]$, $z_2 \in [1.4, 1.5]$, and $z_3 \in [3, 4.2]$

B. $z_1 \in [-4.37, -3.36]$, $z_2 \in [-1.56, -1.22]$, and $z_3 \in [0.9, 1.8]$

C. $z_1 \in [-0.93, -0.13]$, $z_2 \in [0.56, 0.69]$, and $z_3 \in [3, 4.2]$

D. $z_1 \in [-4.37, -3.36]$, $z_2 \in [-0.42, -0.3]$, and $z_3 \in [4.7, 5.5]$

E. $z_1 \in [-4.37, -3.36]$, $z_2 \in [-0.72, -0.66]$, and $z_3 \in [0.1, 1]$

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5. 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.*

$$f(x) = 12x^4 + 67x^3 + 41x^2 - 190x - 200$$

A. $z_1 \in [-4.22, -3.73]$, $z_2 \in [-2.07, -1.91]$, $z_3 \in [-1.72, -0.91]$, and $z_4 \in [1.16, 2.51]$

B. $z_1 \in [-0.74, -0.45]$, $z_2 \in [0.71, 1.07]$, $z_3 \in [1.61, 2.07]$, and $z_4 \in [3.96, 4.1]$

C. $z_1 \in [-5.82, -4.92]$, $z_2 \in [0.04, 0.65]$, $z_3 \in [1.61, 2.07]$, and $z_4 \in [3.96, 4.1]$

D. $z_1 \in [-1.69, -0.82]$, $z_2 \in [1.14, 1.41]$, $z_3 \in [1.61, 2.07]$, and $z_4 \in [3.96, 4.1]$

E. $z_1 \in [-4.22, -3.73]$, $z_2 \in [-2.07, -1.91]$, $z_3 \in [-0.81, -0.68]$, and $z_4 \in [0.26, 0.74]$

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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.*

$$f(x) = 6x^3 - 1x^2 - 75x + 100$$

A. $z_1 \in [-4.3, -3.8]$, $z_2 \in [1.3, 2.11]$, and $z_3 \in [2.3, 3]$

B. $z_1 \in [-3.6, -2.4]$, $z_2 \in [-1.76, -1.57]$, and $z_3 \in [3.8, 5]$

C. $z_1 \in [-4.3, -3.8]$, $z_2 \in [0.07, 0.46]$, and $z_3 \in [-0.7, 0.7]$

D. $z_1 \in [-5.6, -4.6]$, $z_2 \in [-1.14, -0.66]$, and $z_3 \in [3.8, 5]$

E. $z_1 \in [-1.8, 0.9]$, $z_2 \in [-0.51, 0.22]$, and $z_3 \in [3.8, 5]$

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7. 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.*

$$f(x) = 4x^4 + 4x^3 - 55x^2 + 2x + 120$$

A. $z_1 \in [-4.48, -3.24]$, $z_2 \in [-0.91, -0.56]$, $z_3 \in [0.15, 0.41]$, and $z_4 \in [1.93, 2.35]$

B. $z_1 \in [-2.27, -1.92]$, $z_2 \in [-1.37, -1.04]$, $z_3 \in [2.75, 3.28]$, and $z_4 \in [3.83, 4.13]$

C. $z_1 \in [-2.27, -1.92]$, $z_2 \in [-0.46, -0.35]$, $z_3 \in [0.62, 0.83]$, and $z_4 \in [3.83, 4.13]$

D. $z_1 \in [-4.48, -3.24]$, $z_2 \in [-1.55, -1.47]$, $z_3 \in [1.97, 2.59]$, and $z_4 \in [2.48, 2.97]$

E. $z_1 \in [-3.43, -2.27]$, $z_2 \in [-2.05, -1.67]$, $z_3 \in [0.87, 1.55]$, and $z_4 \in [3.83, 4.13]$

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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.

$$\frac{8x^3 + 4x^2 - 48x + 40}{x + 3}$$

A. $a \in [-26, -23], \; b \in [75, 82], \; c \in [-283, -275], \;$ and $r \in [865, 869]$.

B. $a \in [7, 9], \; b \in [21, 32], \; c \in [31, 41], \;$ and $r \in [142, 150]$.

C. $a \in [-26, -23], \; b \in [-70, -64], \; c \in [-253, -250], \;$ and $r \in [-719, -715]$.

D. $a \in [7, 9], \; b \in [-28, -26], \; c \in [59, 66], \;$ and $r \in [-222, -210]$.

E. $a \in [7, 9], \; b \in [-23, -18], \; c \in [11, 15], \;$ and $r \in [1, 10]$.

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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.

$$\frac{20x^3 - 60x + 38}{x + 2}$$

A. $a \in [-41, -37], b \in [77, 84], c \in [-223, -218], \;$ and $r \in [477, 481]$.

B. $a \in [-41, -37], b \in [-87, -76], c \in [-223, -218], \;$ and $r \in [-404, -399]$.

C. $a \in [20, 25], b \in [-65, -59], c \in [117, 124], \;$ and $r \in [-327, -320]$.

D. $a \in [20, 25], b \in [-44, -36], c \in [19, 23], \;$ and $r \in [-5, 1]$.

E. $a \in [20, 25], b \in [34, 43], c \in [19, 23], \;$ and $r \in [71, 84]$.

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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.

$$\frac{8x^3 + 6x^2 - 89x + 63}{x + 4}$$

A. $a \in [7, 12], \; b \in [-39, -27], \; c \in [78, 83], \;$ and $r \in [-343, -339]$.

B. $a \in [-33, -25], \; b \in [125, 135], \; c \in [-628, -621], \;$ and $r \in [2560, 2564]$.

C. $a \in [7, 12], \; b \in [35, 46], \; c \in [63, 69], \;$ and $r \in [311, 316]$.

D. $a \in [7, 12], \; b \in [-28, -24], \; c \in [14, 17], \;$ and $r \in [-1, 4]$.

E. $a \in [-33, -25], \; b \in [-125, -118], \; c \in [-579, -573], \;$ and $r \in [-2247, -2242]$.
