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

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

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

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

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

   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.

$$\frac{20x^3 - 111x^2 + 136x - 46}{x - 4}$$

   A. $a \in [15, 22],\ b \in [-32, -22],\ c \in [12, 13],$ and $r \in [-3, 7]$.

   B. $a \in [15, 22],\ b \in [-52, -50],\ c \in [-21, -16],$ and $r \in [-99, -95]$.

   C. $a \in [78, 81],\ b \in [207, 212],\ c \in [968, 973],$ and $r \in [3840, 3847]$.

   D. $a \in [78, 81],\ b \in [-435, -429],\ c \in [1860, 1866],$ and $r \in [-7488, -7478]$.

   E. $a \in [15, 22],\ b \in [-198, -186],\ c \in [897, 904],$ and $r \in [-3646, -3644]$.

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3. 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.*

$$f(x) = 15x^3 + 74x^2 - 11x - 30$$

   A. $z_1 \in [-1.25, -0.62],\ z_2 \in [0.35, 0.72],$ and $z_3 \in [4.3, 5.7]$

   B. $z_1 \in [-1.58, -1.33],\ z_2 \in [1.07, 1.73],$ and $z_3 \in [4.3, 5.7]$

   C. $z_1 \in [-5.29, -4.92],\ z_2 \in [-1.79, -1.65],$ and $z_3 \in [1.4, 1.8]$

D. $z_1 \in [-5.29, -4.92]$, $z_2 \in [-0.96, 0.05]$, and $z_3 \in [0.6, 1]$

E. $z_1 \in [-2.41, -1.81]$, $z_2 \in [-0.16, 0.46]$, and $z_3 \in [4.3, 5.7]$

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4. 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.*

$$f(x) = 10x^4 + 31x^3 - 189x^2 - 430x + 200$$

A. $z_1 \in [-5.53, -4.12]$, $z_2 \in [-0.63, 0.47]$, $z_3 \in [2.43, 2.57]$, and $z_4 \in [3.19, 4.43]$

B. $z_1 \in [-4.68, -3.44]$, $z_2 \in [-0.63, 0.47]$, $z_3 \in [2.43, 2.57]$, and $z_4 \in [4.32, 5.1]$

C. $z_1 \in [-4.68, -3.44]$, $z_2 \in [-2.7, -2.28]$, $z_3 \in [0.38, 0.44]$, and $z_4 \in [4.32, 5.1]$

D. $z_1 \in [-5.53, -4.12]$, $z_2 \in [-2.7, -2.28]$, $z_3 \in [0.38, 0.44]$, and $z_4 \in [3.19, 4.43]$

E. $z_1 \in [-4.68, -3.44]$, $z_2 \in [-2.27, -1.69]$, $z_3 \in [0.43, 0.57]$, and $z_4 \in [4.32, 5.1]$

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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.

$$\frac{12x^3 + 39x^2 - 30}{x + 3}$$

A. $a \in [9, 17], b \in [71, 78], c \in [222, 226]$, and $r \in [644, 648]$.

B. $a \in [9, 17], b \in [-12, -7], c \in [36, 42]$, and $r \in [-181, -170]$.

C. $a \in [-39, -30], b \in [145, 149], c \in [-445, -440]$, and $r \in [1291, 1299]$.

D. $a \in [-39, -30], b \in [-71, -65], c \in [-208, -200]$, and $r \in [-652, -650]$.

E. $a \in [9, 17], b \in [-4, 4], c \in [-13, -2]$, and $r \in [-5, -2]$.

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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.*

$$f(x) = 20x^3 - 63x^2 - 78x + 40$$

A. $z_1 \in [-1.8, -1.17]$, $z_2 \in [0.21, 0.57]$, and $z_3 \in [3.67, 4.79]$

B. $z_1 \in [-4.14, -3.54]$, $z_2 \in [-0.19, -0.04]$, and $z_3 \in [4.3, 5.34]$

C. $z_1 \in [-4.14, -3.54]$, $z_2 \in [-2.73, -2.44]$, and $z_3 \in [0.54, 0.84]$

D. $z_1 \in [-0.91, -0.54]$, $z_2 \in [2.4, 2.52]$, and $z_3 \in [3.67, 4.79]$

E. $z_1 \in [-4.14, -3.54]$, $z_2 \in [-0.45, -0.35]$, and $z_3 \in [1.04, 1.87]$

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

$$\frac{10x^3 - 28x^2 - 14x + 19}{x - 3}$$

A. $a \in [29, 37]$, $b \in [-118, -112]$, $c \in [338, 341]$, and $r \in [-1002, -999]$.

B. $a \in [10, 12]$, $b \in [-3, 9]$, $c \in [-8, -3]$, and $r \in [-6, -4]$.

C. $a \in [10, 12]$, $b \in [-62, -52]$, $c \in [155, 164]$, and $r \in [-462, -460]$.

D. $a \in [29, 37]$, $b \in [61, 70]$, $c \in [169, 177]$, and $r \in [531, 539]$.

E. $a \in [10, 12]$, $b \in [-14, -6]$, $c \in [-30, -20]$, and $r \in [-46, -36]$.

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

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

A. $\pm 1, \pm 2$

B. $\pm 1, \pm 3$

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

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

$$\frac{25x^3 + 105x^2 - 82}{x + 4}$$

A. $a \in [16, 31], b \in [5, 8], c \in [-22, -14],$ and $r \in [-2, 3]$.

B. $a \in [16, 31], b \in [203, 207], c \in [816, 821],$ and $r \in [3198, 3200]$.

C. $a \in [-106, -96], b \in [-299, -289], c \in [-1184, -1174],$ and $r \in [-4805, -4799]$.

D. $a \in [-106, -96], b \in [503, 513], c \in [-2021, -2019],$ and $r \in [7998, 7999]$.

E. $a \in [16, 31], b \in [-21, -19], c \in [97, 107],$ and $r \in [-582, -579]$.

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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.*

$$f(x) = 12x^4 + 95x^3 + 152x^2 - 175x - 300$$

A. $z_1 \in [-5, -4.72], \; z_2 \in [-5.1, -1.9], z_3 \in [-0.98, -0.28],$ and $z_4 \in [0.59, 0.79]$

B. $z_1 \in [-0.94, -0.69], \; z_2 \in [0.6, 1.1], z_3 \in [2.84, 3.23],$ and $z_4 \in [4.78, 5.41]$

C. $z_1 \in [-0.54, -0.28], \; z_2 \in [2.3, 3.2], z_3 \in [4.71, 5.08],$ and $z_4 \in [4.78, 5.41]$

D. $z_1 \in [-1.79, -1.21], \; z_2 \in [1, 2.4], z_3 \in [2.84, 3.23],$ and $z_4 \in [4.78, 5.41]$

E. $z_1 \in [-5, -4.72], \; z_2 \in [-5.1, -1.9], z_3 \in [-2.16, -0.94],$ and $z_4 \in [0.95, 1.49]$
