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

$$\frac{9x^3 - 6x^2 - 51x - 39}{x - 3}$$

A. $a \in [7, 16], \; b \in [20, 28], \; c \in [7, 14], \text{ and } r \in [-5, 1].$

B. $a \in [7, 16], \; b \in [12, 13], \; c \in [-29, -21], \text{ and } r \in [-93, -91].$

C. $a \in [22, 30], \; b \in [74, 79], \; c \in [174, 179], \text{ and } r \in [482, 484].$

D. $a \in [7, 16], \; b \in [-41, -28], \; c \in [47, 55], \text{ and } r \in [-184, -176].$

E. $a \in [22, 30], \; b \in [-91, -84], \; c \in [209, 214], \text{ and } r \in [-673, -663].$

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

$$f(x) = 2x^4 + 3x^3 + 6x^2 + 5x + 6$$

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

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

C. $\pm 1, \pm 2$

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

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

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3. 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.*

$$f(x) = 12x^4 + 35x^3 - 23x^2 - 140x - 100$$

A. $z_1 \in [-6, -1], \; z_2 \in [0.2, 0.57], z_3 \in [1.92, 2.12], \text{ and } z_4 \in [4, 9]$

B. $z_1 \in [-6, -1], \; z_2 \in [1.22, 1.29], z_3 \in [1.54, 1.77], \text{ and } z_4 \in [0, 4]$

C. $z_1 \in [-6, -1], \; z_2 \in [0.59, 0.96], z_3 \in [0.61, 0.88], \text{ and } z_4 \in [0, 4]$

D. $z_1 \in [-6, -1]$, $z_2 \in [-1.42, -0.64]$, $z_3 \in [-0.94, -0.45]$, and $z_4 \in [0, 4]$

E. $z_1 \in [-6, -1]$, $z_2 \in [-1.72, -1.33]$, $z_3 \in [-1.28, -1.01]$, and $z_4 \in [0, 4]$

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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.

$$\frac{15x^3 + 66x^2 + 15x - 31}{x + 4}$$

A. $a \in [-61, -59]$, $b \in [302, 308]$, $c \in [-1214, -1208]$, and $r \in [4805, 4810]$.

B. $a \in [14, 17]$, $b \in [120, 132]$, $c \in [519, 521]$, and $r \in [2043, 2046]$.

C. $a \in [14, 17]$, $b \in [-1, 8]$, $c \in [-10, -4]$, and $r \in [0, 10]$.

D. $a \in [-61, -59]$, $b \in [-174, -173]$, $c \in [-681, -677]$, and $r \in [-2762, -2750]$.

E. $a \in [14, 17]$, $b \in [-15, -8]$, $c \in [60, 62]$, and $r \in [-333, -330]$.

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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.

$$\frac{4x^3 + 12x^2 - 11}{x + 2}$$

A. $a \in [2, 7], b \in [3.6, 4.5], c \in [-10, -6]$, and $r \in [3, 11]$.

B. $a \in [2, 7], b \in [-2, 1.1], c \in [-3, 3]$, and $r \in [-11, -9]$.

C. $a \in [-13, -7], b \in [26.7, 30.3], c \in [-56, -51]$, and $r \in [98, 104]$.

D. $a \in [-13, -7], b \in [-7.6, -3.8], c \in [-10, -6]$, and $r \in [-27, -25]$.

E. $a \in [2, 7], b \in [15.7, 20.2], c \in [39, 41]$, and $r \in [68, 73]$.

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

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

A. $\pm 1, \pm 7$

B. $\pm 1, \pm 2$

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

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

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

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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.

$$\frac{12x^3 + 65x^2 - 122}{x + 5}$$

A. $a \in [10, 14], b \in [5, 9], c \in [-28, -24]$, and $r \in [2, 5]$.

B. $a \in [-63, -57], b \in [363, 367], c \in [-1829, -1822]$, and $r \in [9003, 9008]$.

C. $a \in [10, 14], b \in [115, 126], c \in [624, 629]$, and $r \in [2998, 3004]$.

D. $a \in [-63, -57], b \in [-238, -228], c \in [-1181, -1172]$, and $r \in [-5999, -5996]$.

E. $a \in [10, 14], b \in [-9, -6], c \in [40, 45]$, and $r \in [-378, -373]$.

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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.*

$$f(x) = 15x^3 + 31x^2 - 50x - 24$$

A. $z_1 \in [-1.8, -1.17]$, $z_2 \in [0.16, 0.41]$, and $z_3 \in [2.57, 3.15]$

B. $z_1 \in [-1.24, -0.6]$, $z_2 \in [2.46, 2.75]$, and $z_3 \in [2.57, 3.15]$

C. $z_1 \in [-3.68, -2.89]$, $z_2 \in [-3.01, -2.32]$, and $z_3 \in [0.45, 1.14]$

D. $z_1 \in [-4.14, -3.63]$, $z_2 \in [-0.24, 0.29]$, and $z_3 \in [2.57, 3.15]$

E. $z_1 \in [-3.68, -2.89]$, $z_2 \in [-0.43, -0.33]$, and $z_3 \in [1.27, 1.74]$

9. 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.*

$$f(x) = 15x^3 - 64x^2 + 12x + 16$$

A. $z_1 \in [-5, -3]$, $z_2 \in [-0.78, -0.27]$, and $z_3 \in [0.22, 0.71]$

B. $z_1 \in [-5, -3]$, $z_2 \in [-1.61, -0.92]$, and $z_3 \in [2.35, 2.71]$

C. $z_1 \in [-5, -3]$, $z_2 \in [-2.24, -1.98]$, and $z_3 \in [0.04, 0.16]$

D. $z_1 \in [-2.5, -1.5]$, $z_2 \in [1.14, 1.56]$, and $z_3 \in [3.73, 4.19]$

E. $z_1 \in [-1.4, 1.6]$, $z_2 \in [0.54, 1.28]$, and $z_3 \in [3.73, 4.19]$

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10. 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.*

$$f(x) = 20x^4 + 129x^3 + 194x^2 - 48x - 160$$

A. $z_1 \in [-4.33, -3.88]$, $z_2 \in [0.19, 0.53]$, $z_3 \in [1.37, 2.44]$, and $z_4 \in [3.2, 5.3]$

B. $z_1 \in [-4.33, -3.88]$, $z_2 \in [-2.12, -1.88]$, $z_3 \in [-1.01, -0.29]$, and $z_4 \in [1, 1.5]$

C. $z_1 \in [-4.33, -3.88]$, $z_2 \in [-2.12, -1.88]$, $z_3 \in [-1.98, -1.21]$, and $z_4 \in [0.2, 0.9]$

D. $z_1 \in [-0.99, -0.08]$, $z_2 \in [1.24, 1.6]$, $z_3 \in [1.37, 2.44]$, and $z_4 \in [3.2, 5.3]$

E. $z_1 \in [-1.61, -1.07]$, $z_2 \in [0.76, 1.2]$, $z_3 \in [1.37, 2.44]$, and $z_4 \in [3.2, 5.3]$
