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

$$\frac{25x^3 + 130x^2 + 13x - 57}{x + 5}$$

A. $a \in [22, 26],\ b \in [4, 6],\ c \in [-12, -10],$ and $r \in [-2, 10]$.

B. $a \in [-126, -120],\ b \in [754, 761],\ c \in [-3762, -3759],$ and $r \in [18747, 18755]$.

C. $a \in [22, 26],\ b \in [-26, -16],\ c \in [133, 135],$ and $r \in [-857, -852]$.

D. $a \in [-126, -120],\ b \in [-499, -492],\ c \in [-2462, -2455],$ and $r \in [-12367, -12364]$.

E. $a \in [22, 26],\ b \in [255, 262],\ c \in [1283, 1293],$ and $r \in [6381, 6384]$.

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

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

A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 7}$

B. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 5}$

C. $\pm 1, \pm 5$

D. $\pm 1, \pm 7$

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

$$\frac{10x^3 - 35x^2 + 49}{x - 3}$$

A. $a \in [29, 42], b \in [51, 57], c \in [165, 167],$ and $r \in [544, 546]$.

B. $a \in [10, 16], b \in [-5, -4], c \in [-21, -9],$ and $r \in [2, 9]$.

C. $a \in [29, 42], b \in [-126, -123], c \in [374, 379],$ and $r \in [-1077, -1073]$.

D. $a \in [10, 16], b \in [-66, -59], c \in [194, 196],$ and $r \in [-536, -532]$.

E. $a \in [10, 16], b \in [-17, -9], c \in [-30, -26],$ and $r \in [-17, -9]$.

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

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

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

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

C. $\pm 1, \pm 2$

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

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

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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.

$$\frac{15x^3 - 65x^2 - 75x + 121}{x - 5}$$

A. $a \in [13, 18], \ b \in [-7, -4], \ c \in [-99, -90],$ and $r \in [-260, -254]$.

B. $a \in [13, 18], \ b \in [7, 15], \ c \in [-33, -23],$ and $r \in [-4, 1]$.

C. $a \in [74, 80], \ b \in [310, 316], \ c \in [1470, 1476],$ and $r \in [7496, 7497]$.

D. $a \in [13, 18], \ b \in [-146, -139], \ c \in [621, 627],$ and $r \in [-3008, -2998]$.

E. $a \in [74, 80], \ b \in [-444, -437], \ c \in [2125, 2127],$ and $r \in [-10506, -10500]$.

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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.

$$\frac{4x^3 - 49x - 56}{x - 4}$$

A. $a \in [2, 7], b \in [14, 19], c \in [10, 19],$ and $r \in [-1, 7]$.

B. $a \in [2, 7], b \in [4, 14], c \in [-14, -10],$ and $r \in [-98, -92]$.

C. $a \in [12, 17], b \in [-66, -57], c \in [199, 210],$ and $r \in [-886, -880]$.

D. $a \in [2, 7], b \in [-17, -13], c \in [10, 19],$ and $r \in [-121, -114]$.

E. $a \in [12, 17], b \in [59, 67], c \in [199, 210],$ and $r \in [768, 773]$.

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7. 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.*

$$f(x) = 20x^3 - 91x^2 - 65x + 100$$

A. $z_1 \in [-1.7, -1],\ z_2 \in [0.77, 0.91],$ and $z_3 \in [4.87, 5.26]$

B. $z_1 \in [-1.1, 0.3],\ z_2 \in [1.15, 1.8],$ and $z_3 \in [4.87, 5.26]$

C. $z_1 \in [-5.1, -4.8],\ z_2 \in [-1.11, -0.79],$ and $z_3 \in [1.18, 1.55]$

D. $z_1 \in [-5.1, -4.8],\ z_2 \in [-1.42, -0.83],$ and $z_3 \in [0.64, 1.05]$

E. $z_1 \in [-5.1, -4.8],\ z_2 \in [-0.25, 0.24],$ and $z_3 \in [4.87, 5.26]$

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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.*

$$f(x) = 6x^3 - 31x^2 + 48x - 20$$

A. $z_1 \in [-2.54, -2.1],\ z_2 \in [-2.51, -1.6],$ and $z_3 \in [-0.7, -0.65]$

B. $z_1 \in [0.46, 0.88],\ z_2 \in [1.75, 2.24],$ and $z_3 \in [2.47, 2.61]$

C. $z_1 \in [-2.08, -1.81],\ z_2 \in [-1.95, -1.48],$ and $z_3 \in [-0.46, -0.34]$

D. $z_1 \in [-5.74, -4.33],\ z_2 \in [-2.51, -1.6],$ and $z_3 \in [-0.37, -0.26]$

E. $z_1 \in [0.22, 0.57],\ z_2 \in [1.2, 1.91],$ and $z_3 \in [1.84, 2.03]$

---

9. 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.*

$$f(x) = 25x^4 + 220x^3 + 449x^2 - 154x - 120$$

A. $z_1 \in [-3.57, -2.48]$, $z_2 \in [-0.56, 0.27]$, $z_3 \in [3, 5]$, and $z_4 \in [4.82, 5.61]$

B. $z_1 \in [-5.6, -4.25]$, $z_2 \in [-4.15, -3.93]$, $z_3 \in [-0.4, 0.6]$, and $z_4 \in [0.43, 1.42]$

C. $z_1 \in [-2.04, -1.41]$, $z_2 \in [2.41, 3.13]$, $z_3 \in [3, 5]$, and $z_4 \in [4.82, 5.61]$

D. $z_1 \in [-5.6, -4.25]$, $z_2 \in [-4.15, -3.93]$, $z_3 \in [-4.5, -0.5]$, and $z_4 \in [1.58, 2.04]$

E. $z_1 \in [-0.97, -0.33]$, $z_2 \in [0.15, 0.8]$, $z_3 \in [3, 5]$, and $z_4 \in [4.82, 5.61]$

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10. 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.*

$$f(x) = 15x^4 - 16x^3 - 321x^2 + 630x - 200$$

A. $z_1 \in [-6.4, -4.2]$, $z_2 \in [0.58, 1.03]$, $z_3 \in [2.2, 2.55]$, and $z_4 \in [3.73, 4.83]$

B. $z_1 \in [-6.4, -4.2]$, $z_2 \in [0.19, 0.4]$, $z_3 \in [1.57, 1.71]$, and $z_4 \in [3.73, 4.83]$

C. $z_1 \in [-4.8, -3.3]$, $z_2 \in [-2.88, -2.32]$, $z_3 \in [-0.76, -0.6]$, and $z_4 \in [4.84, 5.6]$

D. $z_1 \in [-4.8, -3.3]$, $z_2 \in [-1.76, -1.38]$, $z_3 \in [-0.44, -0.4]$, and $z_4 \in [4.84, 5.6]$

E. $z_1 \in [-6.4, -4.2]$, $z_2 \in [-4.09, -3.84]$, $z_3 \in [-0.31, -0.01]$, and $z_4 \in [4.84, 5.6]$
