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

$$\frac{10x^3 + 5x^2 - 80x - 79}{x - 3}$$

A. $a \in [8, 13],\ b \in [-27, -24],\ c \in [-7, -3],$ and $r \in [-67, -59]$.

B. $a \in [8, 13],\ b \in [33, 37],\ c \in [18, 32],$ and $r \in [-7, -3]$.

C. $a \in [26, 34],\ b \in [-87, -79],\ c \in [174, 178],$ and $r \in [-608, -597]$.

D. $a \in [26, 34],\ b \in [91, 99],\ c \in [196, 207],$ and $r \in [534, 543]$.

E. $a \in [8, 13],\ b \in [24, 27],\ c \in [-31, -27],$ and $r \in [-143, -134]$.

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

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

A. $\pm 1, \pm 3$

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

C. $\pm 1, \pm 5$

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

$$\frac{16x^3 - 52x^2 + 33}{x - 3}$$

A. $a \in [12, 25], b \in [-20, -18], c \in [-41, -36],$ and $r \in [-52, -45]$.

B. $a \in [47, 51], b \in [-199, -188], c \in [586, 591],$ and $r \in [-1736, -1727]$.

C. $a \in [47, 51], b \in [85, 98], c \in [275, 280],$ and $r \in [852, 865]$.

D. $a \in [12, 25], b \in [-9, -2], c \in [-14, -9],$ and $r \in [-6, -1]$.

E. $a \in [12, 25], b \in [-102, -93], c \in [296, 308],$ and $r \in [-868, -866]$.

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

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

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

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

C. $\pm 1, \pm 3$

D. $\pm 1, \pm 2$

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.

$$\frac{8x^3 + 4x^2 - 28x - 27}{x - 2}$$

A. $a \in [3, 15],\ b \in [-15, -10],\ c \in [-4, 1],$ and $r \in [-21, -18]$.

B. $a \in [3, 15],\ b \in [8, 13],\ c \in [-16, -15],$ and $r \in [-51, -38]$.

C. $a \in [13, 20],\ b \in [36, 39],\ c \in [38, 48],$ and $r \in [60, 67]$.

D. $a \in [3, 15],\ b \in [17, 21],\ c \in [9, 18],$ and $r \in [-6, -2]$.

E. $a \in [13, 20],\ b \in [-31, -24],\ c \in [25, 36],$ and $r \in [-86, -81]$.

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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.

$$\frac{8x^3 - 26x^2 + 13}{x - 3}$$

A. $a \in [22, 30], b \in [45, 50], c \in [134, 140],$ and $r \in [425, 428]$.

B. $a \in [22, 30], b \in [-100, -94], c \in [293, 299],$ and $r \in [-870, -867]$.

C. $a \in [2, 11], b \in [-12, -5], c \in [-25, -15],$ and $r \in [-32, -26]$.

D. $a \in [2, 11], b \in [-52, -45], c \in [147, 152],$ and $r \in [-442, -429]$.

E. $a \in [2, 11], b \in [-7, 6], c \in [-6, -4],$ and $r \in [-8, 4]$.

---

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.*

$$f(x) = 10x^3 + 49x^2 + 68x + 20$$

A. $z_1 \in [-2.62, -2.31],\ z_2 \in [-3, -1],$ and $z_3 \in [-0.4, 1.6]$

B. $z_1 \in [0.36, 0.41],\ z_2 \in [2, 3],$ and $z_3 \in [2.5, 4.5]$

C. $z_1 \in [-2.62, -2.31],\ z_2 \in [-3, -1],$ and $z_3 \in [-0.4, 1.6]$

D. $z_1 \in [0.36, 0.41],\ z_2 \in [2, 3],$ and $z_3 \in [2.5, 4.5]$

E. $z_1 \in [0.18, 0.35],\ z_2 \in [2, 3],$ and $z_3 \in [5, 8]$

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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.*

$$f(x) = 25x^3 - 50x^2 - 9x + 18$$

A. $z_1 \in [-1.9, -1.2],\ z_2 \in [1.33, 2.15],$ and $z_3 \in [1.9, 2.26]$

B. $z_1 \in [-2.3, -1.8],\ z_2 \in [-0.74, -0.57],$ and $z_3 \in [0.47, 0.92]$

C. $z_1 \in [-1.1, 0.4],\ z_2 \in [0.5, 0.94],$ and $z_3 \in [1.9, 2.26]$

D. $z_1 \in [-2.3, -1.8],\ z_2 \in [-0.25, 0.02],$ and $z_3 \in [2.6, 3.82]$

E. $z_1 \in [-2.3, -1.8],\ z_2 \in [-1.74, -1.03],$ and $z_3 \in [1.55, 1.94]$

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9. 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.*

$$f(x) = 8x^4 + 18x^3 - 75x^2 - 46x + 120$$

A. $z_1 \in [-3, 2],\ z_2 \in [-1.26, -1.24], z_3 \in [1.34, 1.54],$ and $z_4 \in [3.3, 5.1]$

B. $z_1 \in [-4, -3],\ z_2 \in [-1.5, -1.48], z_3 \in [1.16, 1.4],$ and $z_4 \in [1.1, 3.9]$

C. $z_1 \in [-3, 2],\ z_2 \in [-0.95, -0.78], z_3 \in [0.62, 0.76],$ and $z_4 \in [3.3, 5.1]$

D. $z_1 \in [-3, 2],\ z_2 \in [-0.63, -0.57], z_3 \in [2.75, 3.25],$ and $z_4 \in [3.3, 5.1]$

E. $z_1 \in [-4, -3],\ z_2 \in [-0.74, -0.65], z_3 \in [0.68, 0.81],$ and $z_4 \in [1.1, 3.9]$

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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.*

$$f(x) = 10x^4 - 71x^3 + 174x^2 - 171x + 54$$

A. $z_1 \in [0.65, 0.69],\ z_2 \in [1.66, 1.97], z_3 \in [1.59, 2.31],$ and $z_4 \in [2.92, 3.18]$

B. $z_1 \in [0.53, 0.63],\ z_2 \in [1.16, 1.61], z_3 \in [1.59, 2.31],$ and $z_4 \in [2.92, 3.18]$

C. $z_1 \in [-3.11, -3],\ z_2 \in [-2, -1.87], z_3 \in [-1.86, -1.65],$ and $z_4 \in [-0.71, -0.66]$

D. $z_1 \in [-3.11, -3],\ z_2 \in [-2, -1.87], z_3 \in [-1.54, -1.11],$ and $z_4 \in [-0.6, -0.49]$

E. $z_1 \in [-3.11, -3],\ z_2 \in [-3.1, -2.85], z_3 \in [-2.21, -1.79],$ and $z_4 \in [-0.32, -0.21]$
