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

$$\frac{12x^3 - 63x^2 + 77}{x - 5}$$

A. $a \in [6, 15], b \in [-130, -120], c \in [604, 618]$, and $r \in [-2998, -2988]$.

B. $a \in [6, 15], b \in [-6, -1], c \in [-15, -14]$, and $r \in [2, 4]$.

C. $a \in [6, 15], b \in [-16, -14], c \in [-63, -54]$, and $r \in [-163, -160]$.

D. $a \in [57, 62], b \in [228, 238], c \in [1185, 1187]$, and $r \in [5999, 6003]$.

E. $a \in [57, 62], b \in [-365, -360], c \in [1814, 1822]$, and $r \in [-9003, -8995]$.

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

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

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

B. $\pm 1, \pm 2$

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

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

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.

$$\frac{25x^3 - 105x^2 + 83}{x - 4}$$

A. $a \in [100, 103], b \in [295, 302], c \in [1174, 1190]$, and $r \in [4800, 4809]$.

B. $a \in [100, 103], b \in [-505, -499], c \in [2019, 2022]$, and $r \in [-7997, -7992]$.

C. $a \in [23, 33], b \in [-31, -28], c \in [-91, -89]$, and $r \in [-190, -184]$.

D. $a \in [23, 33], b \in [-8, -1], c \in [-20, -18]$, and $r \in [-5, 7]$.

E. $a \in [23, 33], b \in [-208, -202], c \in [817, 823]$, and $r \in [-3202, -3194]$.

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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.

$$\frac{25x^3 - 15x^2 - 58x - 26}{x - 2}$$

A. $a \in [50, 56]$, $b \in [-119, -112]$, $c \in [169, 173]$, and $r \in [-373, -364]$.

B. $a \in [50, 56]$, $b \in [79, 90]$, $c \in [112, 113]$, and $r \in [198, 205]$.

C. $a \in [24, 26]$, $b \in [34, 42]$, $c \in [11, 14]$, and $r \in [-6, 2]$.

D. $a \in [24, 26]$, $b \in [10, 11]$, $c \in [-49, -45]$, and $r \in [-76, -70]$.

E. $a \in [24, 26]$, $b \in [-70, -61]$, $c \in [70, 73]$, and $r \in [-172, -166]$.

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

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

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

B. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 7}$

C. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 2, \pm 4}$

D. $\pm 1, \pm 7$

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

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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.

$$\frac{10x^3 + 61x^2 + 49x - 28}{x + 5}$$

A. $a \in [-52, -41], \; b \in [-192, -185], \; c \in [-896, -891]$, and $r \in [-4511, -4507]$.

B. $a \in [5, 13], \; b \in [104, 113], \; c \in [601, 607]$, and $r \in [2991, 2994]$.

C. $a \in [5, 13], \; b \in [11, 14], \; c \in [-8, -2]$, and $r \in [2, 7]$.

D. $a \in [5, 13], \; b \in [-5, 2], \; c \in [40, 45]$, and $r \in [-289, -283]$.

E. $a \in [-52, -41], \; b \in [307, 316], \; c \in [-1508, -1500]$, and $r \in [7501, 7504]$.

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7. 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.*

$$f(x) = 12x^4 - 115x^3 + 381x^2 - 512x + 240$$

A. $z_1 \in [-5.47, -4.86], \; z_2 \in [-5.17, -3.55], z_3 \in [-3.03, -2.94]$, and $z_4 \in [-0.39, 0.33]$

B. $z_1 \in [1.22, 1.61], \; z_2 \in [1.31, 1.36], z_3 \in [2.75, 3.19]$, and $z_4 \in [3.54, 4.41]$

C. $z_1 \in [-0.02, 0.89], \; z_2 \in [0.45, 0.97], z_3 \in [2.75, 3.19]$, and $z_4 \in [3.54, 4.41]$

D. $z_1 \in [-4.33, -3.64], \; z_2 \in [-3.31, -2.03], z_3 \in [-2.18, -0.97]$, and $z_4 \in [-1.67, -0.77]$

E. $z_1 \in [-4.33, -3.64], \; z_2 \in [-3.31, -2.03], z_3 \in [-1.05, -0.03]$, and $z_4 \in [-1.08, -0.72]$

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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.*

$$f(x) = 6x^3 + 55x^2 + 150x + 125$$

A. $z_1 \in [-5.83, -4.66], \; z_2 \in [-0.6, 0.4]$, and $z_3 \in [-1.4, 0.6]$

B. $z_1 \in [1.35, 1.96], \; z_2 \in [1.5, 3.5]$, and $z_3 \in [4, 7]$

C. $z_1 \in [-5.83, -4.66], \; z_2 \in [-2.5, -1.5]$, and $z_3 \in [-1.67, -0.67]$

D. $z_1 \in [0.49, 1.39]$, $z_2 \in [5, 6]$, and $z_3 \in [4, 7]$

E. $z_1 \in [-0.16, 0.82]$, $z_2 \in [-0.4, 1.6]$, and $z_3 \in [4, 7]$

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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.*

$$f(x) = 20x^4 - 153x^3 + 276x^2 - 25x - 150$$

A. $z_1 \in [-5.3, -2.5]$, $z_2 \in [-2.38, -1.97]$, $z_3 \in [-0.83, -0.49]$, and $z_4 \in [1.29, 2.23]$

B. $z_1 \in [-0.9, 0.3]$, $z_2 \in [1.18, 1.47]$, $z_3 \in [1.91, 2.44]$, and $z_4 \in [4.84, 5.29]$

C. $z_1 \in [-5.3, -2.5]$, $z_2 \in [-5.23, -4.96]$, $z_3 \in [-2.01, -1.59]$, and $z_4 \in [-0.14, 0.28]$

D. $z_1 \in [-5.3, -2.5]$, $z_2 \in [-2.38, -1.97]$, $z_3 \in [-1.34, -1.18]$, and $z_4 \in [0.41, 0.79]$

E. $z_1 \in [-1.8, -1.2]$, $z_2 \in [0.73, 0.97]$, $z_3 \in [1.91, 2.44]$, and $z_4 \in [4.84, 5.29]$

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10. 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.*

$$f(x) = 15x^3 + 53x^2 + 8x - 48$$

A. $z_1 \in [-0.95, -0.69]$, $z_2 \in [1, 2.3]$, and $z_3 \in [2.77, 3.19]$

B. $z_1 \in [-3.68, -2.98]$, $z_2 \in [-1.3, -0.3]$, and $z_3 \in [0.85, 2.37]$

C. $z_1 \in [-0.68, -0.21]$, $z_2 \in [2.9, 3.6]$, and $z_3 \in [3.97, 4.38]$

D. $z_1 \in [-3.68, -2.98]$, $z_2 \in [-2, -1]$, and $z_3 \in [0.15, 0.88]$

E. $z_1 \in [-1.52, -1.06]$, $z_2 \in [-0.2, 1.1]$, and $z_3 \in [2.77, 3.19]$
