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

$$f(x) = 4x^2 + 6x + 7$$

A. $\pm 1, \pm 7$

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

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

$$\frac{15x^3 - 59x^2 + 34x + 22}{x - 3}$$

A. $a \in [40, 51], \; b \in [73, 81], \; c \in [258, 269], \text{ and } r \in [805, 813].$

B. $a \in [7, 22], \; b \in [-14, -12], \; c \in [-8, -3], \text{ and } r \in [-4, 1].$

C. $a \in [7, 22], \; b \in [-34, -27], \; c \in [-28, -20], \text{ and } r \in [-29, -21].$

D. $a \in [7, 22], \; b \in [-108, -103], \; c \in [341, 347], \text{ and } r \in [-1017, -1015].$

E. $a \in [40, 51], \; b \in [-196, -187], \; c \in [610, 617], \text{ and } r \in [-1833, -1822].$

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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.*

$$f(x) = 15x^3 + 31x^2 - 4x - 12$$

A. $z_1 \in [-2.04, -1.9], \; z_2 \in [-1.77, -1.47], \text{ and } z_3 \in [1.4, 1.95]$

B. $z_1 \in [-2.04, -1.9], \; z_2 \in [-1.02, -0.65], \text{ and } z_3 \in [0.42, 0.9]$

C. $z_1 \in [-0.79, -0.28], \; z_2 \in [0.07, 0.92], \text{ and } z_3 \in [1.78, 2.47]$

D. $z_1 \in [-0.34, 0.28]$, $z_2 \in [1.92, 2.25]$, and $z_3 \in [1.78, 2.47]$

E. $z_1 \in [-1.73, -1.63]$, $z_2 \in [0.97, 1.56]$, and $z_3 \in [1.78, 2.47]$

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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.*

$$f(x) = 15x^4 + 2x^3 - 248x^2 - 32x + 128$$

A. $z_1 \in [-6, -2]$, $z_2 \in [-0.42, -0.13]$, $z_3 \in [3.8, 4.07]$, and $z_4 \in [4, 6]$

B. $z_1 \in [-6, -2]$, $z_2 \in [-0.69, -0.45]$, $z_3 \in [0.76, 0.95]$, and $z_4 \in [4, 6]$

C. $z_1 \in [-6, -2]$, $z_2 \in [-1.56, -1.26]$, $z_3 \in [1.15, 1.45]$, and $z_4 \in [4, 6]$

D. $z_1 \in [-6, -2]$, $z_2 \in [-0.9, -0.68]$, $z_3 \in [0.61, 0.68]$, and $z_4 \in [4, 6]$

E. $z_1 \in [-6, -2]$, $z_2 \in [-1.39, -1.19]$, $z_3 \in [1.46, 1.7]$, and $z_4 \in [4, 6]$

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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.

$$\frac{8x^3 - 24x - 20}{x - 2}$$

A. $a \in [6, 14], b \in [5, 15], c \in [-18, -8]$, and $r \in [-36, -34]$.

B. $a \in [6, 14], b \in [-19, -14], c \in [6, 11]$, and $r \in [-36, -34]$.

C. $a \in [6, 14], b \in [13, 17], c \in [6, 11]$, and $r \in [-9, 4]$.

D. $a \in [12, 18], b \in [-35, -29], c \in [37, 46]$, and $r \in [-101, -98]$.

E. $a \in [12, 18], b \in [27, 33], c \in [37, 46]$, and $r \in [55, 63]$.

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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.

$$f(x) = 9x^3 - 12x^2 - 20x + 16$$

A. $z_1 \in [-1.04, -0.1]$, $z_2 \in [1.43, 2.35]$, and $z_3 \in [1.4, 2.7]$

B. $z_1 \in [-2.26, -1.53]$, $z_2 \in [-1.77, -0.95]$, and $z_3 \in [-0.4, 1]$

C. $z_1 \in [-2.26, -1.53]$, $z_2 \in [-0.29, 0.02]$, and $z_3 \in [3.7, 4.9]$

D. $z_1 \in [-1.52, -1.21]$, $z_2 \in [0.51, 0.98]$, and $z_3 \in [1.4, 2.7]$

E. $z_1 \in [-2.26, -1.53]$, $z_2 \in [-0.98, -0.54]$, and $z_3 \in [1.2, 1.7]$

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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.

$$\frac{15x^3 - 26x^2 - 51x - 16}{x - 3}$$

A. $a \in [15, 19]$, $b \in [19, 28]$, $c \in [6, 8]$, and $r \in [-3, 7]$.

B. $a \in [43, 53]$, $b \in [106, 113]$, $c \in [271, 281]$, and $r \in [812, 816]$.

C. $a \in [15, 19]$, $b \in [-5, 5]$, $c \in [-48, -38]$, and $r \in [-106, -101]$.

D. $a \in [43, 53]$, $b \in [-164, -150]$, $c \in [431, 435]$, and $r \in [-1312, -1303]$.

E. $a \in [15, 19]$, $b \in [-73, -69]$, $c \in [159, 164]$, and $r \in [-503, -498]$.

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

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

A. $\pm 1, \pm 3$

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

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

D. $\pm 1, \pm 2$

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

$$\frac{8x^3 - 42x - 15}{x + 2}$$

A. $a \in [-21, -12], b \in [-41, -30], c \in [-106, -103],$ and $r \in [-229, -223]$.

B. $a \in [-21, -12], b \in [31, 34], c \in [-106, -103],$ and $r \in [193, 199]$.

C. $a \in [0, 12], b \in [-26, -19], c \in [29, 36],$ and $r \in [-106, -99]$.

D. $a \in [0, 12], b \in [-18, -11], c \in [-12, -5],$ and $r \in [4, 9]$.

E. $a \in [0, 12], b \in [16, 20], c \in [-12, -5],$ and $r \in [-40, -31]$.

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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.*

$$f(x) = 8x^4 + 42x^3 + 19x^2 - 102x - 72$$

A. $z_1 \in [-1.63, -1.29],\ z_2 \in [0.36, 0.88], z_3 \in [1.71, 2.43],$ and $z_4 \in [2.9, 5.1]$

B. $z_1 \in [-0.49, 0.11],\ z_2 \in [1.74, 2.29], z_3 \in [2.58, 3.05],$ and $z_4 \in [2.9, 5.1]$

C. $z_1 \in [-4, -3.77],\ z_2 \in [-2.39, -1.93], z_3 \in [-1.09, 0.14],$ and $z_4 \in [0.8, 2.2]$

D. $z_1 \in [-0.83, -0.43],\ z_2 \in [1.3, 1.49], z_3 \in [1.71, 2.43],$ and $z_4 \in [2.9, 5.1]$

E. $z_1 \in [-4, -3.77],\ z_2 \in [-2.39, -1.93], z_3 \in [-2.34, -1.07],$ and $z_4 \in [-0.5, 0.8]$
