1. 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.*

$$f(x) = 20x^3 - 39x^2 - 14x + 24$$

   A. $z_1 \in [-1.65, -1.12]$, $z_2 \in [0.87, 1.97]$, and $z_3 \in [1.94, 2.35]$

   B. $z_1 \in [-1.21, -0.43]$, $z_2 \in [0.73, 1.22]$, and $z_3 \in [1.94, 2.35]$

   C. $z_1 \in [-2.02, -1.74]$, $z_2 \in [-1.61, -1.28]$, and $z_3 \in [1.19, 1.28]$

   D. $z_1 \in [-2.02, -1.74]$, $z_2 \in [-1.13, -0.62]$, and $z_3 \in [0.38, 0.87]$

   E. $z_1 \in [-3.47, -2.95]$, $z_2 \in [-2.19, -1.88]$, and $z_3 \in [-0.01, 0.26]$

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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.

$$\frac{6x^3 + 30x^2 + 48x + 29}{x + 2}$$

   A. $a \in [-13, -7]$, $b \in [52, 56]$, $c \in [-61, -52]$, and $r \in [148, 154]$.

   B. $a \in [-13, -7]$, $b \in [0, 8]$, $c \in [60, 62]$, and $r \in [148, 154]$.

   C. $a \in [4, 13]$, $b \in [8, 15]$, $c \in [12, 18]$, and $r \in [-7, -5]$.

   D. $a \in [4, 13]$, $b \in [40, 46]$, $c \in [130, 142]$, and $r \in [290, 298]$.

   E. $a \in [4, 13]$, $b \in [17, 19]$, $c \in [12, 18]$, and $r \in [3, 9]$.

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

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

   A. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2}$

   B. $\pm 1, \pm 2$

   C. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 5}$

D. $\pm 1, \pm 5$

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

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4. 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.*

$$f(x) = 15x^3 - 8x^2 - 36x - 16$$

A. $z_1 \in [-2.44, -1.88], \ z_2 \in [1.24, 1.38], \text{ and } z_3 \in [0.94, 1.69]$

B. $z_1 \in [-2.44, -1.88], \ z_2 \in [0.16, 0.43], \text{ and } z_3 \in [1.74, 2.21]$

C. $z_1 \in [-2.44, -1.88], \ z_2 \in [0.45, 1.12], \text{ and } z_3 \in [0.58, 1.23]$

D. $z_1 \in [-0.86, -0.75], \ z_2 \in [-0.97, -0.08], \text{ and } z_3 \in [1.74, 2.21]$

E. $z_1 \in [-1.58, -1.32], \ z_2 \in [-1.27, -0.89], \text{ and } z_3 \in [1.74, 2.21]$

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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.

$$\frac{4x^3 + 12x^2 - 20}{x + 2}$$

A. $a \in [-9, -4], b \in [-5, -2], c \in [-15, -7], \text{ and } r \in [-37, -30].$

B. $a \in [-9, -4], b \in [26, 29], c \in [-59, -55], \text{ and } r \in [90, 93].$

C. $a \in [1, 8], b \in [3, 7], c \in [-15, -7], \text{ and } r \in [-4, 3].$

D. $a \in [1, 8], b \in [16, 23], c \in [40, 41], \text{ and } r \in [52, 65].$

E. $a \in [1, 8], b \in [-2, 1], c \in [0, 3], \text{ and } r \in [-26, -16].$

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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.

$$\frac{8x^3 + 38x^2 - 16x - 35}{x + 5}$$

A. $a \in [3, 10],\ b \in [-10, -6],\ c \in [40, 46]$, and $r \in [-299, -298]$.

B. $a \in [-42, -39],\ b \in [237, 243],\ c \in [-1206, -1200]$, and $r \in [5994, 5997]$.

C. $a \in [-42, -39],\ b \in [-165, -160],\ c \in [-831, -823]$, and $r \in [-4170, -4164]$.

D. $a \in [3, 10],\ b \in [77, 79],\ c \in [369, 377]$, and $r \in [1831, 1838]$.

E. $a \in [3, 10],\ b \in [-2, 6],\ c \in [-8, -2]$, and $r \in [-8, -3]$.

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

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

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 3}$

B. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 4}$

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

D. $\pm 1, \pm 3$

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

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8. 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.*

$$f(x) = 8x^4 - 90x^3 + 331x^2 - 441x + 180$$

A. $z_1 \in [0.69, 1],\ z_2 \in [1.43, 2.16], z_3 \in [3.7, 4.09]$, and $z_4 \in [4.67, 5.01]$

B. $z_1 \in [-5.16, -4.81],\ z_2 \in [-4.36, -3.69], z_3 \in [-3.01, -2.4]$, and $z_4 \in [-0.4, 0.06]$

C. $z_1 \in [-5.16, -4.81],\ z_2 \in [-4.36, -3.69], z_3 \in [-1.49, -1.21]$, and $z_4 \in [-0.74, -0.63]$

D. $z_1 \in [-5.16, -4.81],\ z_2 \in [-4.36, -3.69], z_3 \in [-1.84, -1.39]$, and $z_4 \in [-1.1, -0.74]$

E. $z_1 \in [0.62, 0.69]$, $z_2 \in [0.74, 1.48], z_3 \in [3.7, 4.09]$, and $z_4 \in [4.67, 5.01]$

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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.*

$$f(x) = 9x^4 - 72x^3 + 188x^2 - 192x + 64$$

A. $z_1 \in [-4.2, -3.96]$, $z_2 \in [-2.06, -1.99], z_3 \in [-2.06, -1.88]$, and $z_4 \in [-0.45, -0.4]$

B. $z_1 \in [-4.2, -3.96]$, $z_2 \in [-2.06, -1.99], z_3 \in [-1.54, -1.39]$, and $z_4 \in [-0.76, -0.7]$

C. $z_1 \in [-4.2, -3.96]$, $z_2 \in [-2.06, -1.99], z_3 \in [-1.37, -1.31]$, and $z_4 \in [-0.68, -0.6]$

D. $z_1 \in [0.72, 0.84]$, $z_2 \in [1.49, 1.8], z_3 \in [1.9, 2.04]$, and $z_4 \in [3.95, 4.05]$

E. $z_1 \in [0.51, 0.74]$, $z_2 \in [1.21, 1.41], z_3 \in [1.9, 2.04]$, and $z_4 \in [3.95, 4.05]$

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

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

A. $a \in [-9, -2], b \in [15.4, 17.6], c \in [-45, -42]$, and $r \in [92, 93]$.

B. $a \in [4, 6], b \in [-12.8, -9.8], c \in [23, 30]$, and $r \in [-68, -65]$.

C. $a \in [4, 6], b \in [-11.5, -5.8], c \in [4, 5]$, and $r \in [-5, 1]$.

D. $a \in [4, 6], b \in [6.7, 12.3], c \in [4, 5]$, and $r \in [10, 16]$.

E. $a \in [-9, -2], b \in [-17.3, -12.6], c \in [-45, -42]$, and $r \in [-84, -81]$.
