

Math Challenge II-B: Algebra

Answer Key

Areteem Institute

Chapter 1. Factoring

Quick Reponse Questions:

1.11: B

1.16: C

1.12: C

1.17: B

1.13: 3

1.18: C

1.14: D

1.19: B

1.15: A

1.20: D

Practice Questions:

1.21(a): $5xy^2(2x - 3y + 5z)$

1.25: $(x + w)(y + z)$.

1.21(b): $6x(a - b)^3(a - b + 5)$

1.26: $(x + 2)(x^2 - x + 2)$.

1.22: $(x - 2y - z)(x^2 + 4y^2 + z^2 + 2xy + xz - 2yz)$

1.27: $(a^2 - ab + 1)(b^2 + ab + 1)$.

1.23: $(a^{16} + b^{16})(a^8 + b^8)(a^4 + b^4)(a^2 + b^2)(a + b)(a - b)$.

1.28: $(mn + m - n + 1)(mn - m + n + 1)$

1.24(a): $(2p + 3)(p - 1)$.

1.29: $(1 + x^2 + y^2)^2$.

1.24(b): $n = 1, 4, 11$.

1.30: $(a + b)^2(a - b)(a^4 - a^3b + a^2b^2 - ab^3 + b^4)$

Chapter 2. Quadratics

Quick Reponse Questions:

2.11: -4

2.16: -3

2.12: -2

2.17: 4

2.13: -39

2.18: 4

2.14: 5

2.19: 4

2.15: 24

2.20: 2

Practice Questions:

2.21: $x = 0, x_2 - x_1.$

2.26: $q = \sqrt{5} - 2.$

2.22: $-\frac{9}{2} \leq x < -4.$

2.27: $p^2 + 4q + q^2$

2.23: $\frac{132}{289}.$

2.28: $-\sqrt{2}/2 < k \leq 1.$

2.24: $0 < m < 3.$

2.29: No such pairs exist.

2.25: $a = -3.$

2.30: 0 or 16.

Chapter 3. Complex Numbers I

Quick Reponse Questions:

3.11: 23

3.16: D

3.12: 24

3.17: C

3.13: 0.5

3.18: -4

3.14: 61

3.19: 1

3.15: 315

3.20: 11

Practice Questions:

3.21(a): $4 - 9i$.

inner boundary is not included, and the outer boundary is.

3.21(b): $1 - 2i$.

3.25(b): The half plane whose y-coordinate is less than or equal to $\frac{1}{2}$.

3.22: Omitted

3.23: 5

3.26: 0

3.24(a): $2\sqrt{2} \cdot (\cos(\pi/6) + i \sin(\pi/6))$.

3.27: $\pm 2\sqrt{3}$.

3.24(b): $-2\sqrt{3} + 2i$

3.28: 25

3.25(a): Annular region between two concentric circles, both centered at the origin, with radii 2 and 4, where the

3.29: Omitted

3.30: 3

Chapter 4. Complex Numbers II

Quick Reponse Questions:

4.11: C.

4.16: 0

4.12: 81

4.17: 45

4.13: A.

4.18: B.

4.14: C.

4.19: D.

4.15: B.

4.20: D

Practice Questions:

4.21: $k\sqrt{2}(\cos(\pi/4) + i\sin(\pi/4))$

4.26: $\pm\sqrt{2}(\cos(\pi/8) + i\sin(\pi/8)),$
 $\pm\sqrt{2}(\cos(5\pi/8) + i\sin(5\pi/8))$

4.22: $2 - 3i$

4.27: $a = b = -2.$

4.23: 4096

4.28: Omitted

4.24: 0.

4.29: 160

4.25: $\pm 1, \pm i, \pm \frac{\sqrt{2}}{2} + i\frac{\sqrt{2}}{2}$

4.30: $k = 1, 5, 7, 11.$

Chapter 5. Polynomials

Quick Reponse Questions:

5.11: No.

5.16: 2

5.12: 6

5.17: 5

5.13: 5

5.18: 4

5.14: -2

5.19: 2

5.15: C

5.20: 0

Practice Questions:

5.21(a): True.

5.25: $2, 1, -1/2$.

5.21(b): False.

5.26: -2

5.22(a): 7

5.27: -8128 .

5.22(b): 9

5.28: 128.

5.23: -9 .

5.29: 17.

5.24: $\sqrt{5}$

5.30: -41 .

Chapter 6. Advanced Factoring

Quick Reponse Questions:

6.11: B.

6.16: C.

6.12: -1

6.17: A.

6.13: 2

6.18: D.

6.14: 6

6.19: B.

6.15: 1.33

6.20: 2017

Practice Questions:

6.21: $(2x^2 + 5x + 12)(2x + 7)(x - 1)$

6.26: $x(x - 3)(2x + 3)(2x - 3)$.

6.22: $(x^2 + 3x + 1)(x^2 + 4x + 1)$

6.27: $(ac + bd)(bc - ad)$

6.23: $(x + 2)(x + 6)(x^2 + 8x + 10)$

6.28: $(a + 3b)(b + 3c)(c + 3d)$.

6.24: $(x^2 + y^2)(x - y)^2$.

6.29: $(a^2 + a + 1)(a^3 - a + 1)$.

6.25: $(x + 2)(x + 3)(x + 4)$

6.30: 2015

Chapter 7. Solving Equations I

Quick Reponse Questions:

7.11: 0

7.16: 7

7.12: 1

7.17: 2

7.13: 2.2

7.18: 1

7.14: 2

7.19: 6

7.15: -1.5

7.20: 6

Practice Questions:

7.21: $\frac{1}{3}(1 \pm \sqrt{10})$.

7.26: $x = 1$.

7.22: 0.

7.27: $a = 1, b = -1/2$.

7.23: $x = 0$ and $x = -3$.

7.28: No solutions exist.

7.24: -1, 0, 2.

7.29: -2, 1.

7.25: $-\frac{1}{4}$.

7.30: $\frac{3}{2} \pm \frac{\sqrt{5}}{2}$.

Chapter 8. Solving Equations II

Quick Reponse Questions:

8.11: 4

8.16: 32

8.12: C

8.17: -71

8.13: 2

8.18: -26

8.14: 4

8.19: A

8.15: 1

8.20: -3

Practice Questions:

8.21: Domain: $-3 \leq x \leq 3$. Range:
 $0 \leq y \leq 6$.

8.26: No solutions.

8.22: $x = 8$.

8.27: $x = -4, \pm 2$.

8.23: $\frac{3}{4}$.

8.28: $a = \frac{-1}{\sqrt[3]{2}} = \frac{-\sqrt[3]{2}^2}{2}$.

8.24: $x = 4$ and $x = -1$

8.29: 0.

8.25: $x = \frac{\sqrt{21} - 1}{2}$.

8.30: $k > -1/16$ and $k \neq 0$.

Chapter 9. Exponents and Logarithms

Quick Reponse Questions:

9.11: B

9.16: No.

9.12: D

9.17: 3

9.13: 8

9.18: 2

9.14: 2.5

9.19: 1.4

9.15: 11

9.20: 8

Practice Questions:

9.21(a): $f^{-1}(x) = \frac{x-b}{m}$.

9.25(b): $\log_3(x^{7/2})$.

9.21(b): All f with $m = -1$.

9.26: $-\sqrt{11} < x < -\sqrt{2}$ or $\sqrt{2} < x < \sqrt{11}$.

9.22: $m = 3$. $f^{-1}(x) = 3 + \sqrt{x-3}$
for $x \geq 3$.

9.27: $x = \frac{1}{27}$.

9.23: 10.

9.28: $20 < x < 25 - \sqrt{15}$ or $25 + \sqrt{15} < x < 30$.

9.24: Omitted

9.29: $x = 100, x = 1/10$.

9.25(a): $\log_2(4x^{3/2})$.

9.30: -4.