PATHWAY2CAREERS
ALGEBRA II

Pathway2Careers
Algebra II

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ALGEBRA II

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Pathway2Careers Algebra II

NS4ed

About NS4ed

NS4ed is an educational research and development company dedicated to negotiating services for schools, educators, and private institutions. As a rising leader in professional guidance in education, NS4ed partners with state and local entities to provide research, policy and practice deliverables that yield high value and actionable results. NS4ed offers a unique perspective on gathering data and understanding the policy effect and implications for developing models that yield mission critical change in a community, district, or organization.

PATHWAY2CAREERS
Education with Destination

About Pathway2Careers

As NS4ed's flagship program, Pathway2Careers (P2C) is a career readiness solution that support schools in their efforts to prepare students for high-value careers in their communities. P2C delivers access to labor market data to encourage the use of data-informed practices in career education through a number of services, including labor market data tools, career-focused curricula, Perkins V support, and more. As a comprehensive career readiness solution, P2C serves administrators, faculty, students, and parents in making informed decisions that promote employment success.

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Pathway2Careers Geometry Table of Contents

1. Geometry Fundamentals

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 1.1	Points, Lines, and Planes	G.CO.C.8	3, 4, 5	*Multiple*
Lesson 1.2	Measure and Construct Segments	G.CO.D.11, G.CO.D.12	2, 5, 6	*Multiple*
Lesson 1.3	Measure and Construct Angles	G.CO.D.11, G.CO.D.12	1, 5, 6	*Multiple*
Lesson 1.4	Describe Pairs of Angles	G.CO.A.3, G.CO.C.8	1, 5, 7	*Multiple*
Lesson 1.5	Solve Problems Using Pairs of Angles	G.CO.A.3, G.CO.C.8	1, 2, 4	Occupational Therapists
Lesson 1.6	Classify Polygons	G.CO.C.10, G.CO.C.8	2, 4, 8	*Multiple*
Lesson 1.7	Solve Design Problems Using Areas of Figures	G.N.Q.A.1, G.N.Q.A.1.c	1, 2, 4	Meeting, Convention, and Event Planners
Lesson 1.8	Midpoint and Distance in the Coordinate Plane	G.N.Q.A.1, G.N.Q.A.1.c	1, 2, 4	Emergency Medical Technicians & Paramedics
Lesson 1.9	Perimeter in the Coordinate Plane	G.N.Q.A.1, G.N.Q.A.1.c, G.GPE.A.1	1, 2, 4	Fence Erectors
Lesson 1.10	Area in the Coordinate Plane	G.GPE.A.1	1, 4, 6	Computer Specialists

2. Geometric Reasoning

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 2.1	Use Inductive Reasoning	G.CO.C.8, G.CO.C.9, G.CO.C.10	1, 3, 8	*Multiple*
Lesson 2.2	Write Conditional Statements	G.CO.C.8, G.CO.C.9, G.CO.C.10	1, 3	*Multiple*
Lesson 2.3	Use Deductive Reasoning	G.CO.C.8, G.CO.C.9, G.CO.C.10	1, 3	*Multiple*
Lesson 2.4	Biconditional Statements and Definitions	G.CO.C.8, G.CO.C.9, G.CO.C.10	1, 3	*Multiple*
Lesson 2.5	Write Algebraic Proofs	G.CO.C.8, G.CO.C.9, G.CO.C.10	1, 2, 3	*Multiple*
Lesson 2.6	Write Proofs about Segments	G.CO.C.8	1, 2, 3	*Multiple*
Lesson 2.7	Write Proofs about Angles	G.CO.C.8	1, 2, 3	*Multiple*
Lesson 2.8	Use Theorems about Angles	G.CO.C.8	1, 2, 4	Carpenters

3. Parallel and Perpendicular Lines

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 3.1	Pairs of Lines and Angles	G.GPE.A.1, G.GPE.A.2	2, 6, 7	*Multiple*
Lesson 3.2	Parallel Lines and Transversals	G.CO.C.8	1, 3, 7	*Multiple*
Lesson 3.3	Use Properties of Parallel Lines	G.CO.C.8	1, 2, 4	Tree Trimmers and Pruners
Lesson 3.4	Prove Lines are Parallel	G.CO.C.8, G.CO.D.11, G.CO.D.12	3, 5, 8	*Multiple*
Lesson 3.5	Show Lines are Parallel	G.CO.C.8	1, 2, 4	Rail-Track Equipment Operators
Lesson 3.6	Prove Theorems about Perpendicular Lines	G.CO.C.8, G.CO.D.11, G.CO.D.12	2, 3, 5	*Multiple*
Lesson 3.7	Use Properties of Perpendicular Lines	G.CO.C.8	1, 2, 4	Brickmasons and Blockmasons
Lesson 3.8	Find and Use Slopes of Lines	G.GPE.A.1, G.GPE.A.2	1, 2, 7	*Multiple*
Lesson 3.9	Use the Slope Criteria for Parallel and Perpendicular Lines	G.GPE.A.1, G.GPE.A.2	1, 2, 4	Civil Engineers
Lesson 3.10	Lines in the Coordinate Plane	G.GPE.A.1, G.GPE.A.2	1, 6, 8	*Multiple*

4. Transformations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 4.1	Translations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 6, 7	*Multiple*
Lesson 4.2	Apply Translations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 4	Biological Technicians
Lesson 4.3	Reflections	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 6, 7	*Multiple*

Lesson 4.4	Apply Reflections	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 4	Marine Engineers and Naval Architects
Lesson 4.5	Rotations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 6, 7	*Multiple*
Lesson 4.6	Apply Rotations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 4	Air Traffic Controllers
Lesson 4.7	Investigate Symmetry	G.CO.A.2	1, 2, 4	Architecture Professors
Lesson 4.8	Compositions of Transformations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1, 2, 4	Computer Numerically Controlled Machine Tool Programmers
Lesson 4.9	Transformations and Congruence	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1,2,7	*Multiple*
Lesson 4.10	Dilations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2	1,2,6	*Multiple*
Lesson 4.11	Apply Dilations	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.1, G.SRT.A.2, G.MG.A.1	1, 2, 4	Advertising and Promotions Managers
Lesson 4.12	Transformations and Similarity	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.SRT.B.3	1,2,7	*Multiple*

5. Congruent Triangles

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 5.1	Classifying Triangles	G.GPE.A.1, G.GPE.A.2	2, 6, 7	*Multiple*
Lesson 5.2	Angles in Triangles	G.CO.C.9	1, 3, 8	*Multiple*
Lesson 5.3	Apply Angle Relationships in Triangles	G.CO.C.9	1, 2, 3	Physical Therapists
Lesson 5.4	Triangle Congruence	G.CO.A.1, G.CO.A.2, G.CO.A.3, G.CO.A.4, G.CO.B.5, G.CO.B.6, G.SRT.A.2	1, 2, 4	Graphic Designers
Lesson 5.5	Prove Triangle Congruence by SAS and SSS	G.CO.A.1, G.CO.B.5, G.CO.B.6, G.CO.B.7, G.SRT.A.2, G.SRT.B.3	2, 3, 6	*Multiple*
Lesson 5.6	Apply SSS and SAS Triangle Congruence	G.CO.B.7, G.SRT.B.3	1, 2, 4,	Glaziers
Lesson 5.7	Prove Triangle Congruence by ASA and AAS	G.CO.A.1, G.CO.B.5, G.CO.B.6, G.CO.B.7, G.SRT.A.2, G.SRT.B.3	1, 3, 5	*Multiple*
Lesson 5.8	Prove Triangle Congruence by HL	G.CO.B.7, G.SRT.B.3	3, 4, 7	*Multiple*
Lesson 5.9	Apply ASA and AAS Triangle Congruence	G.CO.B.7, G.SRT.B.3	1, 2, 4,	Millwrights
Lesson 5.10	Use Congruent Triangles	G.CO.B.7, G.SRT.B.3	1, 2, 4,	Photogrammetrists
Lesson 5.11	Equilateral and Isosceles Triangles	G.CO.B.7, G.CO.C.9, G.SRT.B.3	2, 3, 8	*Multiple*

6. Relationships Within Triangles

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 6.1	Perpendicular and Angle Bisectors	G.CO.B.7, G.CO.C.8, G.SRT.B.3	1,2, 3, 7	*Multiple*
Lesson 6.2	Bisectors of Triangles	G.CO.C.9	1, 2, 5	*Multiple*
Lesson 6.3	Medians and Altitudes of Triangles	G.CO.C.9	1, 2, 6	*Multiple*
Lesson 6.4	Apply Special Segments in Triangles	G.CO.C.9	1, 2, 4,	Postsecondary Art, Drama, and Music Teachers
Lesson 6.5	The Triangle Midsegment Theorem	G.CO.C.9	1, 2, 6	*Multiple*
Lesson 6.6	Inequalities in One Triangle	G.CO.C.9	1, 2, 7	*Multiple*
Lesson 6.7	Inequalities in Two Triangles	G.CO.C.9	1, 2, 7	*Multiple*
Lesson 6.8	Apply Inequalities in One Triangle and Two Triangles	G.CO.C.9	1, 2, 4,	Commercial Pilots

7. Polygons and Other Quadrilaterals

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 7.1	Angles of Polygons	G.MG.A.1	1, 2, 7	*Multiple*
Lesson 7.2	Properties of Parallelograms	G.CO.C.10	1, 2, 7	*Multiple*

Lesson 7.3	Conditions for Parallelograms	G.CO.C.10	1, 2, 7	*Multiple*
Lesson 7.4	Apply Properties of and Conditions for Parallelograms	G.CO.C.10	1, 2, 4,	Mechanical Drafters
Lesson 7.5	Properties of Special Parallelograms	G.CO.C.10	1, 2, 7	*Multiple*
Lesson 7.6	Properties of Trapezoids and Kites	G.CO.C.8	1, 2, 7	*Multiple*
Lesson 7.7	Identify Special Quadrilaterals	G.CO.C.10	3, 4, 7	Motorcycle Mechanics
Lesson 7.8	Identify Special Quadrilaterals in the Coordinate Plane	G.CO.C.10, G.GPE.A.1	1, 2, 4	Fashion Designers

8. Similarity

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 8.1	Similar Polygons	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b,G.CO.B.7, G.SRT.B.3	1, 2, 4	Set and Exhibit Designers
Lesson 8.2	Prove Triangles Similar by AA	G.CO.B.7, G.CO.C.9, G.SRT.B.3	1, 2, 7	*Multiple*
Lesson 8.3	Prove Triangles Similar by SSS and SAS	G.CO.B.7, G.CO.C.9, G.SRT.B.3, G.GPE.A.1, G.GPE.A.2	1, 2, 7	*Multiple*
Lesson 8.4	Use Similar Triangles	G.CO.B.7, G.SRT.B.3	1, 2, 4	Foresters
Lesson 8.5	Use Proportionality Theorems	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.CO.B.7, G.CO.C.9, G.SRT.B.3	1, 4, 5	*Multiple*
Lesson 8.6	Apply Proportionality Theorems	G.CO.B.7, G.SRT.B.3	1, 2, 4	Urban and Regional Planners

9. Right Triangles and Trigonometry

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 9.1	The Pythagorean Theorem	G.SRT.C.4, G.SRT.C.4.a, G.SRT.C.5, G.SRT.C.5.a, G.GPE.A.3	2, 6, 8	*Multiple*
Lesson 9.2	Apply the Pythagorean Theorem	G.SRT.C.4, G.SRT.C.4.a, G.SRT.C.5, G.SRT.C.5.a, G.GPE.A.3	1, 2, 4	Construction and Building Inspectors
Lesson 9.3	Special Right Triangles	G.SRT.C.4, G.SRT.C.4.a, G.SRT.C.5, G.SRT.C.5.a, G.SRT.C.5.b, G.GPE.A.3	1, 6, 7	*Multiple*
Lesson 9.4	Similar Right Triangles	G.CO.B.7, G.CO.C.9, G.SRT.B.3	2, 3, 7	*Multiple*
Lesson 9.5	Use Similar Right Triangles	G.CO.B.7, G.SRT.B.3	1, 2, 4	Photographers
Lesson 9.6	The Tangent Ratio	G.SRT.C.4, G.SRT.C.4.a, G.SRT.C.5, G.SRT.C.5.a, G.GPE.A.3	1, 5, 8	*Multiple*
Lesson 9.7	The Sine and Cosine Ratios	G.SRT.C.4, G.SRT.C.4.a, G.SRT.C.4.b, G.SRT.C.5, G.SRT.C.5.a, G.GPE.A.3	2, 4, 7	*Multiple*
Lesson 9.8	Apply Trigonometric Ratios in Right Triangles	G.SRT.C.4, G.SRT.C.4.a, G.SRT.C.5, G.SRT.C.5.a, G.GPE.A.3	1, 2, 4	Solar Photovoltaic Installers
Lesson 9.9	Law of Sines and Law of Cosines	G.SRT.C.5, G.SRT.C.5.c	1, 5, 7	*Multiple*
Lesson 9.10	Apply the Law of Sines and the Law of Cosines	G.SRT.C.5, G.SRT.C.5.c	1, 2, 4	Sound Engineering Technicians

10. Circles

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 10.1	Lines and Segments that Intersect Circles	G.C.A.1, G.GPE.A.1	1, 5, 6	*Multiple*
Lesson 10.2	Finding Arc Measures	G.C.A.1	1, 6, 7	*Multiple*
Lesson 10.3	Using Chords	G.GPE.A.2	1, 6, 7	*Multiple*
Lesson 10.4	Inscribed Angles	G.GPE.A.1, G.GPE.A.2	1, 6, 7	*Multiple*
Lesson 10.5	Inscribed Polygons	G.GPE.A.1, G.GPE.A.2	1, 6, 7	*Multiple*
Lesson 10.6	Apply Central Angles and Inscribed Angles	G.GPE.A.1	1, 2, 4	Security and Fire Alarm Systems Installers
Lesson 10.7	Angle Relationships in Circles	G.N.Q.A.1.a., G.N.Q.A.1.b.	1, 2, 7	*Multiple*
Lesson 10.8	Segment Relationships in Circles	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b	1, 2, 7	*Multiple*
Lesson 10.9	Apply Segment Relationships in Circles	G.C.A.1, G.GPE.A.1	1, 2, 4	Life, Physical and Social Science Technicians
Lesson 10.10	Circles in the Coordinate Plane	G.GPE.A.1	1, 2, 7	*Multiple*
Lesson 10.11	Apply Circles in the Coordinate Plane	G.GPE.A.1	4, 6, 7	Geoscientists
Lesson 10.12	Equation of a Parabola	G.GPE.A.1	1,2, 7	*Multiple*

11. Circumference and Area

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 11.1	Find Areas of Triangles using Trigonometry	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	1, 2, 4	Surveyors
Lesson 11.2	Areas of Parallelograms, Trapezoids, and Regular Polygons	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	1, 4, 6	Fish and Game Wardens
Lesson 11.3	Areas of Composite Figures	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	1, 2, 4	Appraisers and Assessors of Real Estate
Lesson 11.4	Circumference and Arc Length	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.C.A.1	1, 2, 7	*Multiple*
Lesson 11.5	Apply Circumference and Arc Length	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.MG.A.1	2, 4, 7	Mechanical Engineering Technicians
Lesson 11.6	Areas of Circles and Sectors	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.C.A.1	1, 2, 7	*Multiple*
Lesson 11.7	Apply Areas of Circles and Sectors	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.MG.A.1	1, 2, 4	Cardiovascular Technologists and Technicians

12. Surface Area and Volume

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 12.1	Cross Sections of Solids	preparing for G.GMD.A.1, G.GMD.A.2	4, 5, 8	*Multiple*
Lesson 12.2	Visualizing Solids	preparing for G.GMD.A.1, G.GMD.A.2	1, 2, 4	Architectural and Civil Drafters
Lesson 12.3	Surface Areas of Prisms and Pyramids	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	2, 4, 7	*Multiple*
Lesson 12.4	Apply Surface Areas of Prisms and Pyramids	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.MG.A.1	1, 2, 4	Anthropologists and Archeologists
Lesson 12.5	Surface Areas of Cylinders and Cones	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	1, 2, 4	*Multiple*
Lesson 12.6	Surface Areas of Spheres	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	3, 4, 7	*Multiple*
Lesson 12.7	Apply Surface Areas of Cylinders, Cones, and Spheres	G.MG.A.1	1, 2, 4	Industrial Production Managers
Lesson 12.8	Volumes of Prisms and Pyramids	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	2, 6, 8	*Multiple*
Lesson 12.9	Apply Volumes of Prisms and Pyramids	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.GMD.A.1, G.GMD.A.2, G.MG.A.1	1, 2, 4	Heating, Air Conditioning and Refrigeration Mechanics and Installers
Lesson 12.10	Volumes of Cylinders and Cones	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	1, 4, 7	*Multiple*
Lesson 12.11	Volumes of Spheres	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c	3, 6, 8	*Multiple*
Lesson 12.12	Apply Volumes of Cylinders, Cones and Spheres	G.N.Q.A.1, G.N.Q.A.1.a, G.N.Q.A.1.b, G.N.Q.A.1.c, G.GMD.A.1, G.GMD.A.2	1, 2, 4	Architectural Engineers
Lesson 12.13	Solids of Revolution	G.CO.C.8, G.CO.D.11	2, 7, 8	*Multiple*

13. Probability and Decision Making

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 13.1	Probability and Set Theory	G.S.CP.A.1, G.S.CP.A.1.a, G.S.CP.B.2, G.S.CP.C.4	2, 5, 7	*Multiple*
Lesson 13.2	Find Probabilities Using Permutations and Combinations	G.S.CP.C.4	1, 4, 8	*Multiple*
Lesson 13.3	Disjoint and Overlapping Events	G.S.CP.B.3, G.S.CP.B.3.a, G.S.CP.B.3.b	3, 5, 7	*Multiple*

Lesson 13.4	Apply Probabilities of Disjoint and Overlapping Events	G.S.CP.A.1, G.S.CP.A.1.a, G.S.CP.A.1.b, G.S.CP.B.2, G.S.CP.C.4	1, 2, 4	Health Educators
Lesson 13.5	Conditional Probability	G.S.CP.A.1, G.S.CP.A.1.a, G.S.CP.B.2	1, 2, 7	*Multiple*
Lesson 13.6	Apply Conditional Probabilities	G.S.CP.A.1, G.S.CP.A.1.a, G.S.CP.A.1.b, G.S.CP.B.2, G.S.CP.C.4	1, 2, 5	Personal Financial Advisors
Lesson 13.7	Independent Events	G.S.CP.B.2	2, 4, 8	*Multiple*
Lesson 13.8	Applying Probabilities of Independent Events	G.S.CP.A.1, G.S.CP.A.1.a, G.S.CP.A.1.b, G.S.CP.B.2, G.S.CP.C.4	1, 2, 6	Information Security Analysts
Lesson 13.9	Dependent Events	G.S.CP.B.2	1, 4, 7	*Multiple*
Lesson 13.10	Applying Probabilities of Dependent Events	G.S.CP.B.2, G.S.CP.C.4	1, 2, 4	Gaming Managers

Pathway2Careers Algebra II

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- **Algebra II (One-Year Course)**
- **Algebra IIa**
- **Algebra IIb**

Algebra II vs. Algebra IIa and Algebra IIb

Because Algebra II is challenging coursework, Pathway2Careers supports flexibility in how Algebra II is delivered. Schools may choose to assign Algebra II as a one-year course or as a two-year course (with Algebra IIa in the first year and Algebra IIb in the second year).

Delivering Algebra II as a two-year course with Algebra IIa and Algebra IIb, the curriculum uses the major and supporting content of the standards. Enrichment lessons are included to support a deeper dive into the content as students work towards conceptual understanding and application of mathematical concepts.

For Algebra II as a one-year course, the table of contents and pacing guides denote which lessons are considered supporting or enrichment content. While these lessons are still available to assign and teach, teachers may choose to omit or abbreviate these lessons based on their students' needs and timing.

The split course structure of Algebra IIa and Algebra IIb is maintained in a full year course to support teachers in their instructional planning. This way, teachers view the intended instructional sequence of the supporting or enrichment lessons as they fit logically within the course.

See the "Pathway2Careers Instructional Scope and Sequence" for more information.

Pathway2Careers Algebra II Table of Contents

1. Expressions and Equations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
S A2A Lesson 1.1	Solving Equations in One Variable	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b, A2.A.CED.A.1, A2.A.C	1, 6, 7, 8	*Multiple*
S A2A Lesson 1.2	Isolating a Variable	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.	2, 3, 4	*Multiple*
S A2A Lesson 1.3	Writing Equations	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.	1, 4, 5, 7	*Multiple*
S A2A Lesson 1.4	Absolute Value	A2.A.CED.A.1, A2.A.CED.A.2	1, 4, 5, 8	*Multiple*
S A2A Lesson 1.5	Applying Absolute Value	A2.A.CED.A.1, A2.A.CED.A.2	1, 5, 7	Instructional Coordinators
A2A Lesson 1.6	Exponents and Radicals	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	1, 2, 7, 8	*Multiple*
A2A Lesson 1.7	Applying Exponents and Radicals	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	2, 5, 6	Environmental Scientists and Specialists
A2A Lesson 1.8	Scientific Notation	A2.N.RN.A.1, A2.N.RN.A.1.a	1, 4, 7, 8	*Multiple*

2. Linear Functions and Graphs

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2A Lesson 2.1	Function Notation	A2.F.BF.A.1, A2.F.BF.A.1.a, A2.F.BF.B.4, A2.F.BF.B.4.a, A2.F.BF.B.	1, 3, 6, 7	*Multiple*
A2A Lesson 2.2	Functions, Relations, and Inverses	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.F.BF.B.4, A2.F.BF.B.4.a, A2.F.BF.B.4.	1, 7, 8	*Multiple*
S A2A Lesson 2.3	Slopes, Intercepts, and Linear Graphs	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.CED.A.2, A2.F.IF.A.1, A2.F.IF.A.2	4, 6, 7	*Multiple*
S A2A Lesson 2.4	Applying Slope, Intercepts, and Linear Graphs	A2.N.Q.A.1, A2.N.Q.A.1.b, A2.N.Q.A.1.c, A2.A.CED.A.2, A2.F.IF.A.	1, 2, 7	Secondary School Teachers
S A2A Lesson 2.5	Writing Linear Equations	A2.A.CED.A.1, A2.A.CED.A.2	4, 6, 7	*Multiple*
S A2A Lesson 2.6	Applying Writing Linear Equations	A2.N.Q.A.1, A2.N.Q.A.1.b, A2.N.Q.A.1.c, A2.A.CED.A.1,	1, 2, 4	Civil Engineering Technicians
S A2A Lesson 2.7	Parallel & Perpendicular Lines	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 6, 8	*Multiple*
S A2A Lesson 2.8	Applying Parallel & Perpendicular Lines	A2.N.Q.A.1, A2.N.Q.A.1.b, A2.N.Q.A.1.c, A2.N.Q.A.1.d	1, 2, 5	Producers
A2A Lesson 2.9	Inequalities and Their Graphs	A2.A.CED.A.1	3, 4, 7, 8	*Multiple*
A2A Lesson 2.10	Compound Inequalities	A2.A.CED.A.1	6, 7, 8	*Multiple*

3. Systems of Linear Equations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
S A2A Lesson 3.1	Solving Linear Systems of Two Equations	A2.A.REI.B.3, A2.F.BF.A.1, A2.F.BF.A.1.a	1, 5, 6	*Multiple*
A2A Lesson 3.2	Solving Linear Systems of Three Equations	A2.A.REI.B.3, A2.A.REI.B.4, A2.F.BF.A.1, A2.F.BF.A.1.a	1, 4, 8	*Multiple*
A2A Lesson 3.3	Applying Solving Linear Systems of Three Equations	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.REI.B.3, A2.A.REI.B.4	1, 2, 5	Information Security Analysts
A2A Lesson 3.4	Using Systems of Linear Equations	A2.A.REI.B.4	1, 4, 6	*Multiple*
A2A Lesson 3.5	Systems of Two Linear Inequalities	A2.N.M.A.3	1, 4, 5	*Multiple*
A2A Lesson 3.6	Applying Systems of Two Linear Inequalities	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.N.M.A.3	1, 4, 5	Interior Designers
E A2A Lesson 3.7	Using Systems of Inequalities to Find the Feasible Region	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.N.M.A.3	1, 2, 4	Computer Network Specialists

4. Matrices

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2A Lesson 4.1	Matrices and Systems of Equations	A2.N.M.A.1, A2.N.M.A.2, A2.N.M.A.2.a, A2.N.M.A.3	1, 3, 4	*Multiple*
A2A Lesson 4.2	Matrix Operations	A2.N.M.A.1, A2.N.M.A.2, A2.N.M.A.2.a, A2.N.M.A.2.b, A2.N.M.A.2	1, 2, 4, 7	*Multiple*
A2A Lesson 4.3	Matrix Multiplication	A2.N.M.A.2, A2.N.M.A.2.b, A2.N.M.A.2.c, A2.N.M.A.2.d	1, 4, 5	*Multiple*
A2A Lesson 4.4	Applying Matrix Multiplication	A2.N.M.A.2, A2.N.M.A.2.b, A2.N.M.A.2.c, A2.N.M.A.2.d	1, 2, 7	Bioinformatics Scientists
A2A Lesson 4.5	Determinants and Cramer's Rule	A2.N.M.A.2.d, A2.N.M.A.3	1, 4, 5	*Multiple*
A2A Lesson 4.6	Inverse Matrices	A2.N.M.A.2, A2.N.M.A.2.b, A2.N.M.A.2.c, A2.N.M.A.2.d,	1, 3, 4, 7	*Multiple*
A2A Lesson 4.7	Applying Inverse Matrices	A2.N.M.A.3	1, 2, 5	Aircraft Mechanics and Service Technicians

5. Quadratic Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2A Lesson 5.1	Graphing in Vertex Form	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b, A2.F.IF.B.5, A2.F.IF.	3, 7, 8	*Multiple*
A2A Lesson 5.2	Graphing in Standard Form	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b, A2.F.IF.B.5, A2.F.IF.	2, 6, 7, 8	*Multiple*
A2A Lesson 5.3	Applying Graphing in Standard Form	A2.F.IF.B.5, A2.F.IF.B.5.a	2, 4, 5	Tool and Die Makers
A2A Lesson 5.4	Finding Zeros Using the Quadratic Formula	A2.A.APR.A.1, A2.F.IF.B.5, A2.F.IF.B.5.a	1, 7, 8	*Multiple*
A2A Lesson 5.5	Applying Properties of Quadratics	A2.A.APR.A.1, A2.F.IF.B.5, A2.F.IF.B.5.a	2, 4, 5	Structural Iron and Steel Workers
A2A Lesson 5.6	Solving Quadratic Functions by Factoring	A2.F.IF.B.5, A2.F.IF.B.5.a, A2.F.LE.A.1, A2.F.LE.A.1.b	2, 7	*Multiple*
A2A Lesson 5.7	Solving Quadratic Functions Using Square Roots	A2.F.LE.A.1, A2.F.LE.A.1.b	1, 6, 7	*Multiple*
A2A Lesson 5.8	Applying Solving Quadratic Functions Using Square Roots	A2.F.LE.A.1, A2.F.LE.A.1.b	1, 4, 5	Airfield Operations Specialists

6. Absolute Value and Piecewise Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2A Lesson 6.1	Graphing Absolute Value Functions	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b	1, 4, 6, 7	*Multiple*
A2A Lesson 6.2	Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.b	1, 4, 8	*Multiple*
A2A Lesson 6.3	Applying Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.b	2, 3, 5	Audio and Video Technicians
A2A Lesson 6.4	Graphing Absolute Value Inequalities	A2.A.SSE.A.1.a	1, 4, 6, 7	*Multiple*
A2A Lesson 6.5	Applying Graphing Absolute Value Inequalities	A2.A.SSE.A.1.a	4, 5, 6	Power Plant Operators
A2A Lesson 6.6	Piecewise Functions	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 4, 6, 7	*Multiple*
A2A Lesson 6.7	Applying Piecewise Functions	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 3, 4	Film and Video Editors

7. Polynomial Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2A Lesson 7.1	Intro to Polynomials	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	4, 5, 6	*Multiple*
A2A Lesson 7.2	Long Division, the Factor Theorem, and the Remainder Theorem	A2.A.APR.A.1, A2.A.APR.A.2	4, 7, 8	*Multiple*
A2A Lesson 7.3	Synthetic Division	A2.A.APR.A.1	7, 8	*Multiple*
A2A Lesson 7.4	Applying Polynomial Division	A2.A.APR.A.1	5, 6, 7	Chemical Engineers

	A2A Lesson 7.5	Solving Polynomial Equations by Factoring	A2.A.APR.A.1, A2.A.APR.A.2, A2.A.CED.A.1, A2.A.CED.A.2	1, 2, 3, 5, 7	*Multiple*
	A2A Lesson 7.6	Graphs of Polynomial Functions	A2.A.APR.A.2, A2.A.CED.A.2, A2.F.IF.B.6, A2.F.IF.B.6.a, A2.F.IF.B.6.	1, 3, 4, 5	*Multiple*
	A2A Lesson 7.7	Applying Graphs of Polynomial Functions	A2.A.CED.A.2	1, 4, 5	Electrical Engineers
8. Radical Functions and Rational Exponents					
		Lesson Topic	**TN State Standard**	**Mathematical Practices**	**Occupation**
	A2A Lesson 8.1	Roots	A2.N.RN.A.1.b, A2.N.RN.A.1.c	2, 6, 8	*Multiple*
	A2A Lesson 8.2	Properties of Rational Exponents	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	1, 2, 6, 8	*Multiple*
	A2A Lesson 8.3	Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.a, A2.F.BF.A.1.b, A2.F.BF.B.4, A2.F.BF.B.	2, 6, 8	*Multiple*
	A2A Lesson 8.4	Applying Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.a, A2.F.BF.A.1.b, A2.F.BF.B.4, A2.F.BF.B.	2, 7, 9	Materials Engineer
	A2A Lesson 8.5	Graphing Radical Functions	A2.N.RN.A.1.c	2, 7, 8	*Multiple*
	A2A Lesson 8.6	Solving Radical Equations	A2.A.CED.A.1, A2.A.CED.A.2, A2.A.REI.A.2	1, 2	*Multiple*
	A2A Lesson 8.7	Applying Radical Functions	A2.N.Q.A.1, A2.N.Q.A.1.a, A2.A.CED.A.1, A2.A.CED.A.2, A2.A.REI.A.	1, 2, 4, 5, 7	Electrical and Electronics Drafters
9. Discrete Math and Combinatorics					
		Lesson Topic	**TN State Standard**	**Mathematical Practices**	**Occupation**
S	A2A Lesson 9.1	Counting, Permutations, and Combinations	A2.S.CP.B.2, A2.S.CP.B.2.a, A2.S.CP.B.2.b	1, 2, 5	*Multiple*
	A2A Lesson 9.2	Probability and Compound Probability	A2.S.CP.A.1, A2.S.CP.C.4	1, 5, 7	*Multiple*
	A2A Lesson 9.3	Discrete Probability	A2.S.CP.A.1, A2.S.CP.C.4	1, 2, 8	*Multiple*
	A2A Lesson 9.4	Applying Discrete Probability	A2.S.CP.A.1, A2.S.CP.C.4	1, 4, 6	Heavy and Tractor-Trailor Truck Drivers
	A2A Lesson 9.5	The Binomial Theorem	A2.S.CP.A.1, A2.S.CP.C.4	2, 6, 7	*Multiple*
E	A2A Lesson 9.6	The Traveling Salesperson Problem	A2.S.CP.A.1	1, 2, 4, 7	*Multiple*
E	A2A Lesson 9.7	Optimal Solutions	A2.S.CP.A.1	1, 2, 4	Multiple
10. Data					
		Lesson Topic	**TN State Standard**	**Mathematical Practices**	**Occupation**
S	A2A Lesson 10.1	Measures of Central Tendency	A2.S.ID.A.1, A2.S.ID.A.2	3, 5, 6, 7	*Multiple*
S	A2A Lesson 10.2	Measures of Variation	A2.F.IF.A.2, A2.S.ID.A.1, A2.S.ID.A.2	5, 6, 7	*Multiple*
	A2A Lesson 10.3	The Normal Distribution	A2.S.ID.A.1, A2.S.ID.A.2, A2.S.ID.A.3	1, 3, 5, 8	*Multiple*
	A2A Lesson 10.4	Applying the Normal Distribution	A2.N.Q.A.1, A2.N.Q.A.1.a, A2.S.ID.A.1, A2.S.ID.A.2, A2.S.ID.A.3	1, 2, 4, 5, 6	Nurse Practitioners
	A2A Lesson 10.5	Randomness and Bias	A2.S.ID.A.1, A2.S.IC.A.1. A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.	1, 3, 8	*Multiple*
	A2A Lesson 10.6	Applying Randomness and Bias	A2.S.IC.A.1, A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.S.CP.B.3	1, 2, 4	Lodging Managers
E	A2A Lesson 10.7	Hypotheses	A2.S.IC.A.1, A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.S.CP.B.3	1, 3, 5	*Multiple*
E	A2A Lesson 10.8	Applying Hypotheses	A2.S.IC.A.1, A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.S.CP.B.3	1, 6, 7	Accountants and Auditors
1. Rational Functions					
		Lesson Topic	**TN State Standard**	**Mathematical Practices**	**Occupation**

A2B Lesson 1.1	Multiplying and Dividing Rational Expressions	A2.A.APR.A.2	1, 3, 6, 8	*Multiple*
A2B Lesson 1.2	Adding and Subtracting Rational Expressions	A2.A.APR.A.2	1, 4, 6	*Multiple*
A2B Lesson 1.3	Solving Rational Equations	A2.A.REI.A.2, A2.A.APR.A.2	1, 2, 5, 6	*Multiple*
A2B Lesson 1.4	Applying Solving Rational Equations	A2.A.REI.A.2, A2.A.APR.A.2	1, 2, 4	Respiratory Therapists
A2B Lesson 1.5	Using Polynomial Division to Solve Rational Equations	A2.A.CED.A.1, A2.A.CED.A.2	1, 2, 4, 6	*Multiple*
A2B Lesson 1.6	Applying Using Polynomial Division to Solve Rational Equations	A2.A.CED.A.1, A2.A.CED.A.2	1, 2, 3, 4	Budget Analysts
A2B Lesson 1.7	Graphing Rational Functions	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 7, 8	*Multiple*

2. Conic Sections

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2B Lesson 2.1	Parabolas	A2.A.CED.A.1, A2.F.IF.A.1, A2.F.IF.B.5.a	1, 2, 6	*Multiple*
A2B Lesson 2.2	Circles	A2.A.CED.A.1, A2.F.IF.A.1, A2.F.IF.A.3	1, 6, 7	*Multiple*
A2B Lesson 2.3	Ellipses	A2.F.IF.B.6, A2.F.IF.B.6.b	1, 2, 7	*Multiple*
A2B Lesson 2.4	Hyperbolas	A2.F.IF.B.6, A2.F.IF.B.6.b	1, 2, 7	*Multiple*
A2B Lesson 2.5	Applying Conic Sections	A2.F.IF.B.6, A2.F.IF.B.6.b	1, 4, 7	Solar Photovoltaic Installers
A2B Lesson 2.6	Translating Conics	A2.F.IF.A.1	2, 7, 8	*Multiple*
A2B Lesson 2.7	Applying Translating Conics	A2.F.IF.B.6, A2.F.IF.B.6.a	2, 4, 7	Museum Technicians and Conservators

3. Complex Numbers

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2B Lesson 3.1	Properties of Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	6, 7, 8	*Multiple*
A2B Lesson 3.2	Operations with Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	1, 3, 8	*Multiple*
A2B Lesson 3.3	Applying Operations with Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	2, 4, 6	Mathematicians
A2B Lesson 3.4	Completing the Square Using Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	2, 6, 8	*Multiple*
A2B Lesson 3.5	Graphing in the Complex Plane	A2.F.BF.A.1.a, A2.F.BF.B.3	1, 2, 5	*Multiple*
A2B Lesson 3.6	Applying Moduli and Arguments	A2.F.IF.A.3	1, 4, 6, 7	Electricians
A2B Lesson 3.7	Distance and Midpoint	A2.F.IF.A.3	2, 8	*Multiple*
A2B Lesson 3.8	Using Notation with Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	1, 6, 8	*Multiple*
A2B Lesson 3.9	Applying Using Notation with Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	2, 4, 5	Electronics Engineers

4. Exponential and Logarithmic Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2B Lesson 4.1	Exponential Growth and Decay	A2.A.CED.A.2, A2.F.IF.B.5, A2.F.IF .B.5.b, A2.S.ID.B.4	2, 4, 7	*Multiple*
A2B Lesson 4.2	Applying Exponential Growth and Decay	A2.N.RN.A.1, A2.N.RN.A.1.b, A2. N.RN.A.1.c, A2.A.CED.A.2, A2.F.IF	1, 2, 4, 7	Microbiologists
A2B Lesson 4.3	The Number e	A2.F.LE.A.1, A2.F.LE.A.1.b, A2.F.L E.A.2	2, 4, 7	*Multiple*
A2B Lesson 4.4	Logarithms	A2.F.LE.A.1, A2.F.LE.A.1.a, A2.F.L E.A.1.b, A2.F.LE.A.1.c	1, 2, 4, 6	*Multiple*

A2B Lesson 4.5	Properties of Logarithmic Functions	A2.F.LE.A.1, A2.F.LE.A.1.b	2, 4, 6, 8	*Multiple*
A2B Lesson 4.6	Applying Properties of Logarithmic Functions	A2.F.LE.A.1, A2.F.LE.A.1.a, A2.F.LE.A.1.b	2, 4, 6	Obstetricians
A2B Lesson 4.7	Solving Exponential and Logarithmic Equations	A2.F.IF.A.1, A2.F.IF.B.4, A2.F.LE.A.1, A2.F.LE.A.1.a, A2.F.LE.A.1.b,	2, 4, 6	*Multiple*
A2B Lesson 4.8	Applying Solving Exponential and Logarithmic Equations	A2.F.IF.A.1, A2.F.IF.B.4, A2.F.LE.A.1, A2.F.LE.A.1.a, A2.F.LE.A.1.b	1, 2, 4, 6	Environmental Scientists and Specialists,

5. Trigonometry

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
S A2B Lesson 5.1	Sine, Cosine, and Tangent in Right Triangles	A2.F.IF.A.3	2 , 4, 6, 7	*Multiple*
A2B Lesson 5.2	Inverse Sine, Cosine, and Tangent in Right Triangles	A2.A.CED.A.3, A2.F.BF.A.1.a	2, 4, 6, 7	*Multiple*
S A2B Lesson 5.3	The Law of Sines and the Law of Cosines	A2.A.CED.A.3, A2.F.IF.A.1	1, 6, 7, 8	*Multiple*
A2B Lesson 5.4	Solving Triangles	A2.A.CED.A.3, A2.F.IF.A.1	1, 2, 4, 5, 6	*Multiple*
A2B Lesson 5.5	Applying Solving Triangles	A2.A.CED.A.3, A2.F.IF.A.1	2, 4, 5	Machinists
A2B Lesson 5.6	More Applying Solving Triangles	A2.F.IF.A.1	1, 3, 5	Welders, Cutters, Solderers, and Brazers
A2B Lesson 5.7	Radians	A2.N.Q.A.1.a, A2.N.Q.A.1.b, A2.N.Q.A.1.c	2, 6, 8	*Multiple*
A2B Lesson 5.8	The Unit Circle	A2.F.IF.A.3	4, 5, 6, 8	*Multiple*
A2B Lesson 5.9	Using the Unit Circle	A2.A.CED.A.2, A2.F.IF.A.1, A2.F.IF.A.3, A2.F.IF.B.4	4, 5, 7	*Multiple*
A2B Lesson 5.10	Applying the Unit Circle	A2.F.IF.A.3	1, 2, 5	Web and Digital Interface Designers

6. Vectors

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2B Lesson 6.1	Magnitude and Directions of Vectors	A2.N.M.A.1	1, 3, 6, 7	*Multiple*
A2B Lesson 6.2	Applying Magnitude and Direction of Vectors	A2.N.M.A.1	1, 4, 5	Traffic Technicians
A2B Lesson 6.3	Vector Components	A2.N.M.A.1	4, 6, 7	*Multiple*
A2B Lesson 6.4	Operations with Vectors	A2.N.M.A.1	1, 4, 5	*Multiple*
A2B Lesson 6.5	Scalars	A2.N.M.A.1, A2.N.M.A.2.a	2, 6, 7	*Multiple*
A2B Lesson 6.6	Applying Scalars	A2.N.M.A.1, A2.N.M.A.2.a	2, 4, 6	Logisticians

7. Trig Identities and Trig Equations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2B Lesson 7.1	Intro to Trigonometric Identities	A2.A.CED.A.3	1, 2, 8	*Multiple*
A2B Lesson 7.2	Sum and Difference Identities	A2.A.CED.A.3	1, 2, 8	*Multiple*
A2B Lesson 7.3	Angle Identities	A2.A.CED.A.3	1, 2, 4, 6	*Multiple*
A2B Lesson 7.4	Proof of the Identities	A2.A.CED.A.3	3, 6, 8	*Multiple*
A2B Lesson 7.5	Trigonometric Equations	A2.A.CED.A.3	6, 8	*Multiple*
A2B Lesson 7.6	Applying Trigonometric Equations	A2.A.CED.A.3	1, 2, 5	Diagnostic Medical Sonographers

8. Series and Sequences

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
A2B Lesson 8.1	Defining Series and Sequences	A2.F.BF.A.2	1, 2, 3, 6, 8	*Multiple*
A2B Lesson 8.2	Arithmetic Series and Sequences	A2.F.BF.A.2	1, 2, 3, 5, 7	*Multiple*
A2B Lesson 8.3	Applying Arithmetic Series and Sequences	A2.N.Q.A.1, A2.N.Q.A.1.a, A2.F.BF.A.2	1, 7, 8	Library Technicians
A2B Lesson 8.4	Geometric Series and Sequences	A2.F.BF.A.2	1, 2, 4, 7	*Multiple*
A2B Lesson 8.5	Applying Geometric Series and Sequences	A2.N.Q.A.1, A2.N.Q.A.1.a, A2.F.BF.A.2	3, 7, 8	Agricultural Technicians
A2B Lesson 8.6	Infinite Geometric Series	A2.F.BF.A.2	1, 2, 3, 5, 7	*Multiple*

EXTENSION OPPORTUNITIES:

9. Binary and Hexadecimal Numbers

	Lesson Topic	NCTM PS	Mathematical Practices	Occupation
E A2B Lesson 9.1	Binary Codes	Communication Connections	1, 2, 4, 8	*Multiple*
E A2B Lesson 9.2	Binary Numbers	Connections Representation	1, 2, 4, 8	*Multiple*
E A2B Lesson 9.3	Bits, Bytes, and Hexadecimal Numbers	Connections Representation	1, 2, 4, 8	*Multiple*
E A2B Lesson 9.4	Applying Bits, Bytes, and Hexadecimal Numbers	Connections Representation	1, 2, 4, 8	Data Administrators

10. Topology

	Lesson Topic	NCTM PS	Mathematical Practices	Occupation
E A2B Lesson 10.1	Topology and Topological Equivalence	Reasoning and Proof Communication	2, 4, 7	*Multiple*
E A2B Lesson 10.2	Mobius Strips	Connections Representation	7, 8	*Multiple*
E A2B Lesson 10.3	Properties of a Torus	Reasoning and Proof Communication	7, 8	*Multiple*
E A2B Lesson 10.4	Topological Properties	Communication, Connections, Representation	2, 7, 8	*Multiple*
E A2B Lesson 10.5	Applying Topological Properties	Communication, Connections, Representation	3, 7, 8	Industrial Machinery Mechanics

11. Logic

	Lesson Topic	NCTM PS	Mathematical Practices	Occupation
E A2B Lesson 11.1	Critical Thinking	Problem Solving Reasoning and Proof	1, 2, 3, 7, 8	*Multiple*
E A2B Lesson 11.2	Applying Critical Thinking	Problem Solving Reasoning and Proof	1, 3, 8	Educational, Guidance and Career Counselors and Advisors
E A2B Lesson 11.3	Sudoku and the Art of Deduction	Problem Solving Connections	1, 3, 7, 8	*Multiple*
E A2B Lesson 11.4	Logic Puzzles- Applying Deduction	Problem Solving Reasoning and Proof	1, 3, 7, 8	*Multiple*
E A2B Lesson 11.5	Cryptography	Problem Solving Representation	1, 5, 7, 8	*Multiple*
E A2B Lesson 11.6	Applying Cryptography	Problem Solving Representation	2, 7, 8	Natural Sciences Managers
E A2B Lesson 11.7	RSA Encryption	Problem Solving Representation	2, 4, 7, 8	*Multiple*

** "S" denotes that the lesson is a Supporting Lesson and may be omitted or abbreviated a the discression of the teacher/district. Pacing for these lessons is not included in the chapter or course totals.

** "E" denotes that the lesson is an Enrichment Lesson and may be omitted or abbreviated a the discression of the teacher/district. Pacing for these lessons is not included in the chapter or course totals.

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1. Expressions and Equations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 1.1	Solving Equations in One Variable	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b, A2.A.CED.A.1, A 2.A.CED.A.2, A2.A.REI.A.1, A2.F.BF.A.1, A2.F.BF.A.1.a	1, 6, 7, 8	*Multiple*
Lesson 1.2	Isolating a Variable	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A. SSE.A.1.b, A2.A.CED.A.1, A2.A.CED.A.2, A2.A.CED.A.3, A2.A.REI .A.1	2, 3, 4	*Multiple*
Lesson 1.3	Writing Equations	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A. SSE.A.1.b, A2.A.CED.A.1, A2.A.CED.A.2, A2.A.CED.A.3	1, 4, 5, 7	*Multiple*
Lesson 1.4	Absolute Value	A2.A.CED.A.1, A2.A.CED.A.2	1, 4, 5, 8	*Multiple*
Lesson 1.5	Applying Absolute Value	A2.A.CED.A.1, A2.A.CED.A.2	1, 5, 7	Instructional Coordinators
Lesson 1.6	Exponents and Radicals	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	1, 2, 7, 8	*Multiple*
Lesson 1.7	Applying Exponents and Radicals	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	2, 5, 6	Environmental Scientists and Specialists
Lesson 1.8	Scientific Notation	A2.N.RN.A.1, A2.N.RN.A.1.a	1, 4, 7, 8	*Multiple*

2. Linear Functions and Graphs

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 2.1	Function Notation	A2.F.BF.A.1, A2.F.BF.A.1.a, A2.F.BF.B.4, A2.F.BF.B.4.a, A2.F.B F.B.4.b, A2.F.BF.B.4.c	1, 3, 6, 7	*Multiple*
Lesson 2.2	Functions, Relations, and Inverses	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.F.BF.B.4, A2.F.BF.B.4.a, A2.F.BF .B.4.b, A2.F.BF.B.4.c	1, 7, 8	*Multiple*
Lesson 2.3	Slopes, Intercepts, and Linear Graphs	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.CED.A.2, A2.F.IF.A.1, A2.F.IF. A.2	4, 6, 7	*Multiple*
Lesson 2.4	Applying Slope, Intercepts, and Linear Graphs	A2.N.Q.A.1, A2.N.Q.A.1.b, A2.N.Q.A.1.c, A2.A.CED.A.2, A2.F.IF .A.1, A2.F.IF.A.2	1, 2, 7	Secondary School Teachers
Lesson 2.5	Writing Linear Equations	A2.A.CED.A.1, A2.A.CED.A.2	4, 6, 7	*Multiple*
Lesson 2.6	Applying Wring Linear Equations	A2.N.Q.A.1, A2.N.Q.A.1.b, A2.N.Q.A.1.c, A2.A.CED.A.1, A2.A.CED.A.2, A2.F.IF.A.2	1, 2, 4	Civil Engineering Technicians
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Lesson 2.8	Applying Parallel & Perpendicular Lines	A2.N.Q.A.1, A2.N.Q.A.1.b, A2.N.Q.A.1.c, A2.N.Q.A.1.d	1, 2, 5	Producers
Lesson 2.9	Inequalities and Their Graphs	A2.A.CED.A.1	3, 4, 7, 8	*Multiple*
Lesson 2.10	Compound Inequalities	A2.A.CED.A.1	6, 7, 8	*Multiple*

3. Systems of Linear Equations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 3.2	Solving Linear Systems of Three Equations	A2.A.REI.B.3, A2.A.REI.B.4, A2.F.BF.A.1, A2.F.BF.A.1.a	1, 4, 8	*Multiple*
Lesson 3.3	Applying Solving Linear Systems of Three Equations	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.A.REI.B.3, A2.A.REI.B.4	1, 2, 5	Information Security Analysts
Lesson 3.4	Using Systems of Linear Equations	A2.A.REI.B.4	1, 4, 6	*Multiple*
Lesson 3.5	Systems of Two Linear Inequalities	A2.N.M.A.3	1, 4, 5	*Multiple*
Lesson 3.6	Applying Systems of Two Linear Inequalities	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.N.M.A.3	1, 4, 5	Interior Designers
Lesson 3.7	Using Systems of Inequalities to Find the Feasible Region	A2.N.Q.A.1, A2.N.Q.A.1.d, A2.N.M.A.3	1, 2, 4	Computer Network Specialists

4. Matrices

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 4.2	Matrix Operations	A2.N.M.A.1, A2.N.M.A.2, A2.N.M.A.2.a, A2.N.M.A.2.b, A2.N. M.A.2.c, A2.N.M.A.2.d	1, 2, 4, 7	*Multiple*
Lesson 4.3	Matrix Multiplication	A2.N.M.A.2, A2.N.M.A.2.b, A2.N.M.A.2.c, A2.N.M.A.2.d	1, 4, 5	*Multiple*
Lesson 4.4	Applying Matrix Multiplication	A2.N.M.A.2, A2.N.M.A.2.b, A2.N.M.A.2.c, A2.N.M.A.2.d	1, 2, 7	Bioinformatics Scientists
Lesson 4.5	Determinants and Cramer's Rule	A2.N.M.A.2.d, A2.N.M.A.3	1, 4, 5	*Multiple*
Lesson 4.6	Inverse Matrices	A2.N.M.A.2, A2.N.M.A.2.b, A2.N.M.A.2.c, A2.N.M.A.2.d, A2.N.M.A.3	1, 3, 4, 7	*Multiple*

Lesson 4.7	Applying Inverse Matrices	A2.N.M.A.3	1, 2, 5	Aircraft Mechanics and Service Technicians

5. Quadratic Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 5.1	Graphing in Vertex Form	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b, A2.F.IF.B.5, A2.F.IF.B.5.a, A2.S.ID.B.4	3, 7, 8	*Multiple*
Lesson 5.2	Graphing in Standard Form	A2.A.SSE.A.1, A2.A.SSE.A.1.a, A2.A.SSE.A.1.b, A2.F.IF.B.5, A2.F.IF.B.5.a, A2.F.BF.B.3	2, 6, 7, 8	*Multiple*
Lesson 5.3	Applying Graphing in Standard Form	A2.F.IF.B.5, A2.F.IF.B.5.a	2, 4, 5	Tool and Die Makers
Lesson 5.4	Finding Zeros Using the Quadratic Formula	A2.A.APR.A.1, A2.F.IF.B.5, A2.F.IF.B.5.a	1, 7, 8	*Multiple*
Lesson 5.5	Applying Properties of Quadratics	A2.A.APR.A.1, A2.F.IF.B.5, A2.F.IF.B.5.a	2, 4, 5	Structural Iron and Steel Workers
Lesson 5.6	Solving Quadratic Functions by Factoring	A2.F.IF.B.5, A2.F.IF.B.5.a, A2.F.LE.A.1, A2.F.LE.A.1.b	2, 7	*Multiple*
Lesson 5.7	Solving Quadratic Functions Using Square Roots	A2.F.LE.A.1, A2.F.LE.A.1.b	1, 6, 7	*Multiple*
Lesson 5.8	Applying Solving Quadratic Functions Using Square Roots	A2.F.LE.A.1, A2.F.LE.A.1.b	1, 4, 5	Airfield Operations Specialists

6. Absolute Value and Piecewise Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 6.2	Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.b	1, 4, 8	*Multiple*
Lesson 6.3	Applying Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.b	2, 3, 5	Audio and Video Technicians
Lesson 6.4	Graphing Absolute Value Inequalities	A2.A.SSE.A.1.a	1, 4, 6, 7	*Multiple*
Lesson 6.5	Applying Graphing Absolute Value Inequalities	A2.A.SSE.A.1.a	4, 5, 6	Power Plant Operators
Lesson 6.6	Piecewise Functions	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 4, 6, 7	*Multiple*
Lesson 6.7	Applying Piecewise Functions	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 3, 4	Film and Video Editors

7. Polynomial Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 7.1	Intro to Polynomials	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	4, 5, 6	*Multiple*
Lesson 7.2	Long Division, the Factor Theorem, and the Remainder Theorem	A2.A.APR.A.1, A2.A.APR.A.2	4, 7, 8	*Multiple*
Lesson 7.3	Synthetic Division	A2.A.APR.A.1	7, 8	*Multiple*
Lesson 7.4	Applying Polynomial Division	A2.A.APR.A.1	5, 6, 7	Chemical Engineers
Lesson 7.5	Solving Polynomial Equations by Factoring	A2.A.APR.A.1, A2.A.APR.A.2, A2.A.CED.A.1, A2.A.CED.A.2	1, 2, 3, 5, 7	*Multiple*
Lesson 7.6	Graphs of Polynomial Functions	A2.A.APR.A.2, A2.A.CED.A.2, A2.F.IF.B.6, A2.F.IF.B.6.a, A2.F.IF.B.6.b	1, 3, 4, 5	*Multiple*
Lesson 7.7	Applying Graphs of Polynomial Functions	A2.A.CED.A.2	1, 4, 5	Electrical Engineers

8. Radical Functions and Rational Exponents

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 8.2	Properties of Rational Exponents	A2.N.RN.A.1, A2.N.RN.A.1.a, A2.N.RN.A.1.b, A2.N.RN.A.1.c	1, 2, 6, 8	*Multiple*
Lesson 8.3	Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.a, A2.F.BF.A.1.b, A2.F.BF.B.4, A2.F.BF.B.4.a, A2.F.BF.B.4.b, A2.F.BF.B.4.c	2, 6, 8	*Multiple*
Lesson 8.4	Applying Composite Functions	A2.F.BF.A.1, A2.F.BF.A.1.a, A2.F.BF.A.1.b, A2.F.BF.B.4, A2.F.BF.B.4.a, A2.F.BF.B.4.b, A2.F.BF.B.4.c	2, 7, 9	Materials Engineer
Lesson 8.5	Graphing Radical Functions	A2.N.RN.A.1.c	2, 7, 8	*Multiple*
Lesson 8.6	Solving Radical Equations	A2.A.CED.A.1, A2.A.CED.A.2, A2.A.REI.A.2	1, 2	*Multiple*
Lesson 8.7	Applying Radical Functions	A2.N.Q.A.1, A2.N.Q.A.1.a, A2.A.CED.A.1, A2.A.CED.A.2, A2.A.REI.A.2	1, 2, 4, 5, 7	Electrical and Electronics Drafters

9. Discrete Math and Combinatorics

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 9.2	Probability and Compound Probability	A2.S.CP.A.1, A2.S.CP.C.4	1, 5, 7	*Multiple*
Lesson 9.3	Discrete Probability	A2.S.CP.A.1, A2.S.CP.C.4	1, 2, 8	*Multiple*
Lesson 9.4	Applying Discrete Probability	A2.S.CP.A.1, A2.S.CP.C.4	1, 4, 6	Heavy and Tractor-Trailor Truck Drivers
Lesson 9.5	The Binomial Theorem	A2.S.CP.A.1, A2.S.CP.C.4	2, 6, 7	*Multiple*

Lesson 9.6	The Traveling Salesperson Problem	A2.S.CP.A.1	1, 2, 4, 7	*Multiple*
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10. Data

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 10.2	Measures of Variation	A2.F.IF.A.2, A2.S.ID.A.1, A2.S.ID.A.2	5, 6, 7	*Multiple*
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Lesson 10.4	Applying the Normal Distribution	A2.N.Q.A.1, A2.N.Q.A.1.a, A2.S.ID.A.1, A2.S.ID.A.2, A2.S.ID.A.3	1, 2, 4, 5, 6	Nurse Practitioners
Lesson 10.5	Randomness and Bias	A2.S.ID.A.1, A2.S.IC.A.1. A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.S.CP.B.3	1, 3, 8	*Multiple*
Lesson 10.6	Applying Randomness and Bias	A2.S.IC.A.1, A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.S.CP.B.3	1, 2, 4	Lodging Managers
Lesson 10.7	Hypotheses	A2.S.IC.A.1, A2.S.IC.A.2, A2.S.IC.A.3, A2.S.CP.B.2, A2.S.CP.B.3	1, 3, 5	*Multiple*
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Lesson 1.3	Solving Rational Equations	A2.A.REI.A.2, A2.A.APR.A.2	1, 2, 5, 6	*Multiple*
Lesson 1.4	Applying Solving Rational Equations	A2.A.REI.A.2, A2.A.APR.A.2	1, 2, 4	Respiratory Therapists
Lesson 1.5	Using Polynomial Division to Solve Rational Equations	A2.A.CED.A.1, A2.A.CED.A.2	1, 2, 4, 6	*Multiple*
Lesson 1.6	Applying Using Polynomial Division to Solve Rational Equations	A2.A.CED.A.1, A2.A.CED.A.2	1, 2, 3, 4	Budget Analysts
Lesson 1.7	Graphing Rational Functions	A2.F.IF.B.6, A2.F.IF.B.6.a	1, 7, 8	*Multiple*

2. Conic Sections

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 2.2	Circles	A2.A.CED.A.1, A2.F.IF.A.1, A2.F.IF.A.3	1, 6, 7	*Multiple*
Lesson 2.3	Ellipses	A2.F.IF.B.6, A2.F.IF.B.6.b	1, 2, 7	*Multiple*
Lesson 2.4	Hyperbolas	A2.F.IF.B.6, A2.F.IF.B.6.b	1, 2, 7	*Multiple*
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3. Complex Numbers

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 3.2	Operations with Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	1, 3, 8	*Multiple*
Lesson 3.3	Applying Operations with Complex Numbers	A2.F.BF.A.1.a, A2.F.BF.B.3	2, 4, 6	Mathematicians
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4. Exponential and Logarithmic Functions

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
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Lesson 4.4	Logarithms	A2.F.LE.A.1, A2.F.LE.A.1.a, A 2.F.LE.A.1.b, A2.F.LE.A.1.c	1, 2, 4, 6	*Multiple*
Lesson 4.5	Properties of Logarithmic Functions	A2.F.LE.A.1, A2.F.LE.A.1.b	2, 4, 6, 8	*Multiple*
Lesson 4.6	Applying Properties of Logarithmic Functions	A2.F.LE.A.1, A2.F.LE.A.1.a, A 2.F.LE.A.1.b	2, 4, 6	Obstetricians
Lesson 4.7	Solving Exponential and Logarithmic Equations	A2.F.IF.A.1, A2.F.IF.B.4, A2. F.LE.A.1, A2.F.LE.A.1.a, A2.F	2, 4, 6	*Multiple*
Lesson 4.8	Applying Solving Exponential and Logarithmic Equations	A2.F.IF.A.1, A2.F.IF.B.4, A2. F.LE.A.1, A2.F.LE.A.1.a, A2.F	1, 2, 4, 6	Environmental Scientists and Specialists, Including Health

5. Trigonometry

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 5.1	Sine, Cosine, and Tangent in Right Triangles	A2.F.IF.A.3	2 , 4, 6, 7	*Multiple*
Lesson 5.2	Inverse Sine, Cosine, and Tangent in Right Triangles	A2.A.CED.A.3, A2.F.BF.A.1.a	2, 4, 6, 7	*Multiple*
Lesson 5.3	The Law of Sines and the Law of Cosines	A2.A.CED.A.3, A2.F.IF.A.1	1, 6, 7, 8	*Multiple*
Lesson 5.4	Solving Triangles	A2.A.CED.A.3, A2.F.IF.A.1	1, 2, 4, 5, 6	*Multiple*
Lesson 5.5	Applying Solving Triangles	A2.A.CED.A.3, A2.F.IF.A.1	2, 4, 5	Machinists
Lesson 5.6	More Applying Solving Triangles	A2.F.IF.A.1	1, 3, 5	Welders, Cutters, Solderers, and Brazers
Lesson 5.7	Radians	A2.N.Q.A.1.a, A2.N.Q.A.1.b, A2.N.Q.A.1.c	2, 6, 8	*Multiple*
Lesson 5.8	The Unit Circle	A2.F.IF.A.3	4, 5, 6, 8	*Multiple*
Lesson 5.9	Using the Unit Circle	A2.A.CED.A.2, A2.F.IF.A.1, A 2.F.IF.A.3, A2.F.IF.B.4	4, 5, 7	*Multiple*
Lesson 5.10	Applying the Unit Circle	A2.F.IF.A.3	1, 2, 5	Web and Digital Interface Designers

6. Vectors

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 6.1	Magnitude and Directions of Vectors	A2.N.M.A.1	1, 3, 6, 7	*Multiple*
Lesson 6.2	Applying Magnitude and Direction of Vectors	A2.N.M.A.1	1, 4, 5	Traffic Technicians
Lesson 6.3	Vector Components	A2.N.M.A.1	4, 6, 7	*Multiple*
Lesson 6.4	Operations with Vectors	A2.N.M.A.1	1, 4, 5	*Multiple*
Lesson 6.5	Scalars	A2.N.M.A.1, A2.N.M.A.2.a	2, 6, 7	*Multiple*
Lesson 6.6	Applying Scalars	A2.N.M.A.1, A2.N.M.A.2.a	2, 4, 6	Logisticians

7. Trig Identities and Trig Equations

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation
Lesson 7.1	Intro to Trigonometric Identities	A2.A.CED.A.3	1, 2, 8	*Multiple*
Lesson 7.2	Sum and Difference Identities	A2.A.CED.A.3	1, 2, 8	*Multiple*
Lesson 7.3	Angle Identities	A2.A.CED.A.3	1, 2, 4, 6	*Multiple*
Lesson 7.4	Proof of the Identities	A2.A.CED.A.3	3, 6, 8	*Multiple*
Lesson 7.5	Trigonometric Equations	A2.A.CED.A.3	6, 8	*Multiple*
Lesson 7.6	Applying Trigonometric Equations	A2.A.CED.A.3	1, 2, 5	Diagnostic Medical Sonographers

8. Series and Sequences

	Lesson Topic	TN State Standard	Mathematical Practices	Occupation

Lesson 8.1	Defining Series and Sequences	A2.F.BF.A.2	1, 2, 3, 6, 8	*Multiple*
Lesson 8.2	Arithmetic Series and Sequences	A2.F.BF.A.2	1, 2, 3, 5, 7	*Multiple*
Lesson 8.3	Applying Arithmetic Series and Sequences	A2.N.Q.A.1, A2.N.Q.A.1.a, A 2.F.BF.A.2	1, 7, 8	Library Technicians
Lesson 8.4	Geometric Series and Sequences	A2.F.BF.A.2	1, 2, 4, 7	*Multiple*
Lesson 8.5	Applying Geometric Series and Sequences	A2.N.Q.A.1, A2.N.Q.A.1.a, A 2.F.BF.A.2	3, 7, 8	Agricultural Technicians
Lesson 8.6	Infinite Geometric Series	A2.F.BF.A.2	1, 2, 3, 5, 7	*Multiple*

9. Binary Numbers

	Lesson Topic	NCTM PS	Mathematical Practices	Occupation
Lesson 9.1	Binary Codes	Communication Connections	1, 2, 4, 8	*Multiple*
Lesson 9.2	Binary Numbers	Connections Representation	1, 2, 4, 8	*Multiple*
Lesson 9.3	Bits, Bytes, and Hexadecimal Numbers	Connections Representation	1, 2, 4, 8	*Multiple*
Lesson 9.4	Applying Bits, Bytes, and Hexadecimal Numbers	Connections Representation	1, 2, 4, 8	Data Administrators

10. Topology

	Lesson Topic	NCTM PS	Mathematical Practices	Occupation
Lesson 10.1	Topology and Topological Equivalence	Reasoning and Proof Communication	2, 4, 7	*Multiple*
Lesson 10.2	Mobius Strips	Connections Representation	7, 8	*Multiple*
Lesson 10.3	Properties of a Torus	Reasoning and Proof Communication	7, 8	*Multiple*
Lesson 10.4	Topological Properties	Communication, Connections, Representation	2, 7, 8	*Multiple*
Lesson 10.5	Applying Topological Properties	Communication, Connections, Representation	3, 7, 8	Industrial Machinery Mechanics

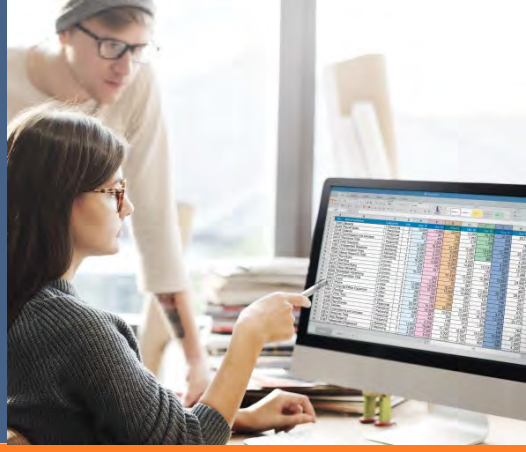
11. Logic

	Lesson Topic	NCTM PS	Mathematical Practices	Occupation
Lesson 11.1	Critical Thinking	Problem Solving Reasoning and Proof	1, 2, 3, 7, 8	*Multiple*
Lesson 11.2	Applying Critical Thinking	Problem Solving Reasoning and Proof	1, 3, 8	Educational, Guidance and Career Counselors and Advisors
Lesson 11.3	Sudoku and the Art of Deduction	Problem Solving Connections	1, 3, 7, 8	*Multiple*
Lesson 11.4	Logic Puzzles- Applying Deduction	Problem Solving Reasoning and Proof	1, 3, 7, 8	*Multiple*
Lesson 11.5	Cryptography	Problem Solving Representation	1, 5, 7, 8	*Multiple*
Lesson 11.6	Applying Cryptography	Problem Solving Representation	2, 7, 8	Natural Sciences Managers
Lesson 11.7	RSA Encryption	Problem Solving Representation	2, 4, 7, 8	*Multiple*

Application Lesson

LESSON 1.6

Apply Solving Rational Equations with More than One Solution



CAREER SPOTLIGHT: Budget Analysts

Occupation Description

Budget analysts evaluate budget proposals, analyze data to determine the costs and benefits of various programs, and recommend funding levels. They oversee spending to ensure that organizations comply with the budget and to determine whether certain programs need changes in funding.

In addition to providing technical analysis, budget analysts must communicate their recommendations effectively within the organization.

Budget analysts working in government may attend committee hearings to explain their recommendations. Occasionally, budget analysts evaluate how well a program is doing, assess policy, and draft budget-related legislation.

Education

A bachelor's degree in fields such as business, finance, or public administration is typically required to become a budget analyst. Some employers prefer to hire applicants who have a master's degree. Sometimes, budget- or finance-related work experience may be substituted for formal education.

Potential Employers

The largest employers of budget analysts are as follows:

Federal government	22%
Educational services	13%
Professional, scientific, and technical services	11%
State government, excluding education and hospitals	11%
Local government, excluding education and hospitals	11%

Watch a video about budget analysts:
https://cdn.careeronestop.org/OccVids/OccupationVideos/13-2031.00.mp4

Career Cluster
Finance

Career Pathway
Business Finance

Career Outlook

- Salary Projections:
  Low-End Salary, $51,220
  Median Salary, $78,970
  High-End Salary, $121,360
- Jobs in 2019: 55,400
- Job Projections for 2029: 57,300 (increase of 3%)

Algebra II Concepts

- Demonstrate how budget analysts might apply solving rational equations.

Is this a good career for me?

Budget Analysts typically do the following:

- Prepare financial documents, reports, or budgets.
- Advise others on financial matters.
- Analyze budgetary or accounting data.
- Verify accuracy of financial information.
- Gather financial records.
- Establish organizational guidelines or policies.
- Analyze business or financial data.

Lesson Objective

In this lesson, you will demonstrate how budget analysts might apply solving rational equations with more than one solution.

Formulas Related to Budgets
The following basic formulas may be used by budget analysts. Each formula can be used in the given form or rewritten in a form appropriate for a specific problem.

Earnings for Employee with Hourly Pay Rate
earnings (dollars) = pay rate (dollars per hour) × time worked (hours)

Profit
profit = revenue – expenses

Profit Margin
$$\text{profit margin} = \frac{\text{revenue} - \text{expenses}}{\text{revenue}}$$

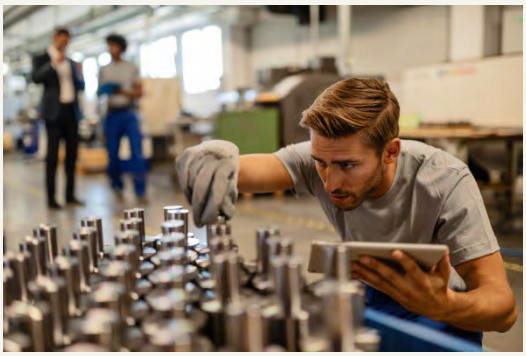
Cost Percentages
$$\text{labor cost percent} = \frac{\text{labor cost}}{\text{revenue}} \times 100$$

$$\text{overhead cost percent} = \frac{\text{overhead cost}}{\text{revenue}} \times 100$$

Projected Revenue
projected revenue = previous revenue × (1 + projected growth rate)

1 Step Into the Career: Apply Solving Rational Equations

A steel manufacturing facility would like to hire an experienced technician and a novice technician to work with the experienced technician. A budget analyst must recommend hourly pay rates for the technicians.



To stay within the budget, the experienced technician can earn $600 per week and the novice technician can earn $480 per week. The novice technician will be paid $3 less per hour than the experienced technician.

If the two technicians work a combined total of 80 hours per week, then what is the hourly pay rate of each technician?

Devise a Plan

Step 1: Organize the given information.

Step 2: Write an equation that relates the given information.

Step 3: Solve the equation.

Step 4: Analyze the results in the context of the problem.

Walk Through the Solution

Step 1: Organize the given information. Let r represent the pay rate (in dollars per hour) for the experienced technician.

	Experienced technician	Novice technician
Weekly earnings (dollars)	600	480
Pay rate (dollars per hour)	r	$r - 3$

The two technicians work a combined total of 80 hours per week.

The novice technician earns \$3 less per hour than the experienced technician.

Step 2: Write an equation.

Start by relating the time worked by each technician in a verbal formula.

Time worked by experienced technician	+	Time worked by novice technician	=	Total time worked by both technicians

The earnings formula can be rewritten to equal time worked by dividing each side by the pay rate.

$$\text{earnings} = \text{pay rate} \times \text{time worked} \rightarrow \frac{\text{earnings}}{\text{pay rate}} = \text{time worked}$$

Rewrite the original verbal equation by substituting earnings divided by pay rate for time.

Experienced technician		**Novice technician**		
$\frac{\text{earnings (dollars)}}{\text{pay rate (dollars per hour)}}$	+	$\frac{\text{earnings (dollars)}}{\text{pay rate (dollars per hour)}}$	=	Total time worked by both technicians

Experienced technician		Novice technician		
$\frac{600}{r}$	+	$\frac{480}{r-3}$	=	80

Use the information in the table in Step 1.

Step 3: Solve the equation $\frac{600}{r} + \frac{480}{r-3} = 80$

$\frac{600}{r} + \frac{480}{r-3} = 80$	Write equation.
$r(r-3)\left(\frac{600}{r} + \frac{480}{r-3}\right) = r(r-3) \cdot 80$	Multiply each side by the LCD, $r(r-3)$.
$\frac{r(r-3)(600)}{r} + \frac{r(r-3)(480)}{r-3} = r(r-3) \cdot 80$	Use Distributive Property.
$(r-3)(600) + r(480) = r(r-3) \cdot 80$	Simplify.
$600r - 1800 + 480r = 80r^2 - 240r$	Simplify.
$80r^2 - 1320r + 1800 = 0$	Write in standard form.
$40(2r^2 - 33r + 45) = 0$	Divide out common factor.
$40(2r-3)(r-15) = 0$	Factor.
$r = 1.5 \quad \text{or} \quad r = 15$	Use the Zero Product Property.

The solutions are 1.5 and 15.

Step 4: Analyze the solutions.

First, check for extraneous solutions by checking the solutions in the original equation.

Check r = 1.5.	**Check r = 15.**
$\frac{600}{r} + \frac{480}{r-3} = 80$	$\frac{600}{r} + \frac{480}{r-3} = 80$
$\frac{600}{1.5} + \frac{480}{1.5-3} = 80$	$\frac{600}{15} + \frac{480}{15-3} = 80$
$400 + (-320) = 80$	$40 + 40 = 80$
$80 = 80$ ✓	$80 = 80$ ✓

Both values produce true statements, so neither of the solutions are extraneous.

Next, check the solutions in the context of the problem.

$r = 1.5$

If $r = 1.5$, then $r - 3 = 1.5 - 3 = -1.5$. So, the pay rates are as follows:

Experienced technician's pay rate = \$1.50 per hour
Novice technician's pay rate = −\$1.50 per hour

This solution does not make sense in the context of the problem since a person cannot have a negative pay rate.

$r = 15$

If $r = 15$, then $r - 3 = 15 - 3 = 12$. So, the pay rates are as follows:

Experienced technician's pay rate = \$15 per hour
Novice technician's pay rate = \$12 per hour

This solution make sense in the context of the problem.

The pay rate for the experienced technician should be \$15 per hour, and the pay rate for the novice technician should be \$12 per hour.

On the Job: Apply Solving Rational Equations

1. A company that makes and sells dog collars sold 2500 dog collars for \$10 each this month. The company wants to increase the price of the dog collars but keep the price less than \$20. They estimate that they will lose 100 sales for each \$1 increase in the price per collar.

The company does not want the price change to affect their advertising cost budget, so the budget analyst must recommend a new price for this situation.

In the budget, 15% of sales revenue is used for advertising costs, and the company plans to spend \$4290 on advertising next month.

a. The revenue from the dog collar sales is given by $(10 + x)(2500 - 100x)$ where x represents each \$1 increase in the price of a collar. Use this expression for sales revenue along with the verbal equation below to write an equation.

$$\begin{array}{c}\text{Advertising cost} \\ \text{percent (as a decimal)}\end{array} = \frac{\text{Advertising cost}}{\text{Sales revenue}}$$

b. Solve the equation from part (a) and analyze the solutions. What dog collar price should the budget analyst recommend? Explain your reasoning.

Career Spotlight: Practice

2. A food packaging company would like to hire a supervisor and a packager to work together on a new production line. A budget analyst must recommend hourly pay rates for the workers.

To stay within the budget, the supervisor can earn $690 per week and the packager can earn $520 per week. The supervisor will be paid $10 more per hour than the packager. If the supervisor and the packager work a combined total of 70 hours per week, then what are the hourly pay rates for the supervisor and the packager?

Devise a Plan

Step 1: Organize the given information.

Step 2: ____?____

Step 3: ____?____

Step 4: ____?____

3. A company that makes customized T-shirts sold 1600 T-shirts for $24 each this month. The company wants to increase their profit margin by increasing their sales and decreasing the T-shirt price but keep the price above $18. They estimate that they will gain 150 sales for each $1 decrease in the price per T-shirt.

The company wants to increase the profit margin for T-shirt sales to 40% next month. They expect to have $26,400 in expenses next month. The budget analyst must recommend a T-shirt price for this situation.

The T-shirt company wants to have a profit margin of 40% next month.

a. The revenue from the T-shirt sales is given by $(24 - x)(1600 + 150x)$ where x represents each $1 decrease in the price of a T-shirt. Use this expression for sales revenue along with the verbal equation for the profit margin to write an equation.

$$\text{Profit margin (as a decimal)} = \frac{\text{Sales revenue} - \text{Expenses}}{\text{Sales revenue}}$$

b. Solve the equation from part (a) and analyze the solutions. What T-shirt price should the budget analyst recommend? Explain your reasoning.

4. Consider the situation in Exercise 3. Suppose the T-shirt company does not have a profit margin goal. However, they do not want the new T-shirt price to affect their overhead cost budget.

In the budget, 10% of sales revenue is used for overhead costs, and the company plans to spend $4180 on overhead costs next month. What T-shirt price greater than $18 should the budget analyst recommend? Explain your reasoning.

Career Spotlight: Check

5. An earth materials company has a new machine for crushing stone. The new machine and the old machine will operate together for a total of 120 hours a week. In the operating budget, $1260 has been allocated for the weekly operating costs of the new machine, and $1250 has been allocated for the operating costs of the old machine. This information is summarized in the table, where t represents the weekly operation hours of the new machine.

	New machine	**Old machine**
Budgeted weekly operating cost (dollars)	1260	1250
Weekly operation (hours)	t	$120 - t$

Which equation can the budget analyst use to make a recommendation for the number of weekly operating hours for each machine?

A. $1260t + 1250(120 - t) = 120$

B. $\left(\frac{1260}{t}\right)\left(\frac{1250}{120 - t}\right) = \frac{2510}{120}$

C. $\frac{1260}{t} = \frac{1250}{120 - t}$

D. $\frac{1260}{t} + \frac{1250}{120 - t} = \frac{2510}{120}$

6. A company that makes and sells automobile parts wants to increase their profit margin to 30% this month. Last month, they had a sales revenue of $80,500 and had $60,375 in expenses. They expect that they will have the same expenses this month. If x represents the percent increase in sales revenue needed for a profit margin of 30% this month, then which equation can be used to find the value x?

A. $0.3 = \frac{80{,}500(1+x)-60{,}375(1+x)}{80{,}500(1+x)}$

B. $0.3 = \frac{80{,}500(1+x)-60{,}375}{80{,}500(1+x)}$

C. $0.7 = \frac{80{,}500-60{,}375}{80{,}500(1+x)}$

D. $0.3 = \frac{80{,}500x}{80{,}500x-60{,}375}$

7. A company that makes and sells smartphone cases sold 4500 cases for $15 each this month. The company wants to increase their smartphone case price, but keep the price less than $20. They estimate that they will lose 200 sales for each $1 increase in the price per case.

In the budget, 8% of sales revenue is budgeted for rent, and the company plans to spend $5576 on rent next month. The company does not want the price change to affect their budget for rent.

The revenue from the smartphone case sales is given by

a. $(15 - x)(4500 - 200)$
b. $(15 + x)(4500 - 200x)$
c. $(15x)(4500 - 200x)$

where x represents each $1 increase in the price of a case.

An equation that can be used to determine the number of $1 increases in price that will not affect the rent budget is

a. $0.08 = \frac{5576}{(15 + x)(4500 - 200x)}$

b. $0.8 = \frac{(15 + x)(4500 - 200x)}{5576}$

c. $0.8 = \frac{5576}{(15 - x)(4500 - 200)}$

The solutions of the equation are

a. $x = 1$ and 11
b. $x = -2$ and 2
c. $x = 2$ and 5.5

So, the budget analyst should recommend that the company change the price of the smartphone cases to

a. $14 per case
b. $16 per case
c. $17 per case

8. A package delivery service would like to hire another driver and a driver's assistant. A budget analyst must recommend hourly pay rates for the workers.

To stay within the budget, the driver can earn $960 per week and the assistant can earn $560 per week. The assistant will be paid $8 less per hour than the driver. If the driver and the assistant work a combined total of 75 hours per week, then what is the hourly pay rate for the assisstant?

A. $12 per hour

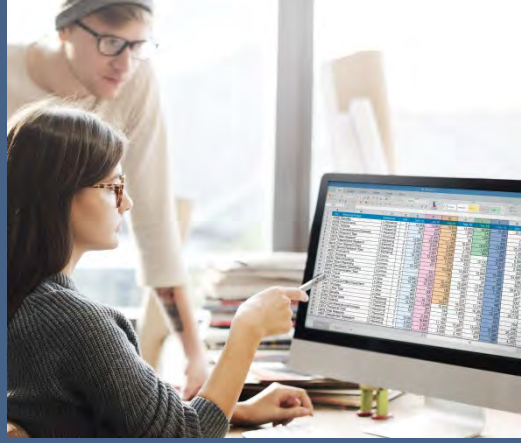
B. $16 per hour

C. $20 per hour

D. $24 per hour

LESSON 1.6 Teacher Edition

Apply Solving Rational Equations with More than One Solution



CAREER SPOTLIGHT: Budget Analysts

Encourage your students to learn more about this occupation and many more in the Pathway2Careers Career Library.

CAREER SPOTLIGHT: Budget Analysts

Budget analysts prepare budget reports, monitor organizational spending, and advise organizations about the details of their finances. They may work for government organizations, private companies, or universities. They analyze data to determine the costs and benefits of various programs, and they recommend funding levels based on their findings. Employers generally require that budget analysts have at least a bachelor's degree in fields such as business, finance, or public administration. Sometimes, budget- or finance-related work experience may be substituted for formal education.

- Discuss being a budget analyst by reading the Career Spotlight together.
- Find college programs that offer degrees in being a budget analyst and learn their prerequisite skills.
- Contact a finance company and discuss the field of business finance and being a budget analyst. Share your findings with your class.

Video: Budget Analyst

Have students watch this video, which describes the work of a budget analyst.

https://cdn.careeronestop.org/OccVids/OccupationVideos/13-2031.00.mp4

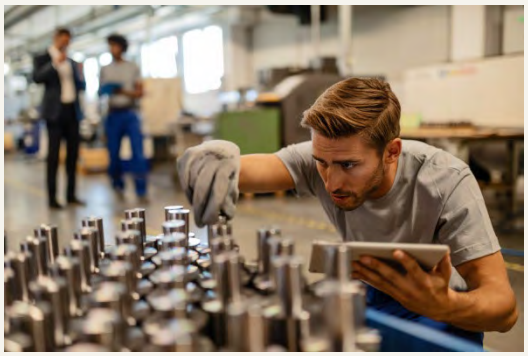
Lesson Objective

Demonstrate how budget analysts might apply solving rational equations with more than one solution.

Teaching Support

1 Step Into the Career: Apply Solving Rational Equations

A steel manufacturing facility would like to hire an experienced technician and a novice technician to work with the experienced technician. A budget analyst must recommend hourly pay rates for the technicians.



To stay within the budget, the experienced technician can earn $600 per week and the novice technician can earn $480 per week. The novice technician will be paid $3 less per hour than the experienced technician.

If the two technicians work a combined total of 80 hours per week, then what is the hourly pay rate of each technician?

Guiding Questions

- In Step 1, suppose r represents the pay rate (in dollars per hour) for the novice technician. In this situation, what algebraic expression represents the pay rate (in dollars per hour) for the experienced technician?
- In Step 2, why is the earnings formula rewritten?
- In Step 4, why is the solution $r = 1.5$ not considered when answering the question?

ENRICHMENT In the example, the quadratic equation is solved by factoring. Remind students that the quadratic equation can also be solved using the Quadratic Formula or by completing the square. Have students solve the quadratic equation using another method.

DIFFERENTATION: ADDITIONAL SUPPORT Students may benefit from a discussion about how to determine the lowest common denominator of the rational equation in Step 3.

On the Job: Apply Solving Rational Equations

Answers

1a. Sample answer: $0.15 = \frac{4290}{(10+x)(2500-10x)}$

1b. $13; The solutions of the equation are $x = 3$ and $x = 12$. When $x = 3$, the new price is $13. When $x = 12$, the new price is $22. The problem states that the price must be less than $20, so $13 is the answer.

Use the questions to check students' understanding:

- Why does $(10 + x)(2500 - 10x)$ represent the sales revenue?
- What is your first step in solving the equation $0.15 = \frac{4290}{(10+x)(2500-10x)}$?

Career Spotlight: Practice

Solution Steps for Exercises 2–4

These steps will help guide students in solving these practice exercises.

Exercise 2

Answer

2. Supervisor is paid $23 per hour and packager is paid $13 per hour.

Sample plan:

Devise a Plan

Step 1: Organize the given information.

Step 2: Write an equation that relates the given information.

Step 3: Solve the equation.

Step 4: Analyze the results in the context of the problem.

Solution Steps

- Organize the given information in a table like the one shown.

	Supervisor	Packager
Weekly earnings (dollars)	690	520
Pay rate (dollars per hour)	$r + 10$	r

- Use the given information to write an equation such as $\frac{690}{r+10} + \frac{520}{r} = 70$.
- Solve the equation. The solutions are $r = 13$ and $r \approx -5.7$.
- Check the results for extraneous solutions, and then determine if the results make sense in the context of the problem. The pay rate cannot be negative, so $r \approx -5.7$ cannot be used to answer the question. So, $r = 13$ and $r + 10 = 23$.

Exercise 3

Answer

3a. Sample answer: $0.4 = \frac{(24-x)(1600+150x)-26{,}400}{(24-x)(1600+150x)}$

3b. $20; The solutions of the equation are $x = 4$ and $x \approx 9.3$. When $x = 4$, the new price is $20. When $x \approx 9.3$, the new price is about $14.70. The problem states that the price must be greater than $18, so $20 is the answer.

Solution Steps

- To write the equation in part (a), substitute 0.4 for the profit margin, $(24 - x)(1600 + 150x)$ for the sales revenue, and 26,400 for the expenses.
- Cross multiply to solve the equation. The solutions are $x = 4$ and $x \approx 9.3$.
- Analyze the results. Only $x = 4$ makes sense in the context of the problem.

Exercise 4

Answer

4. $22; Using the equation $0.1 = \frac{4180}{(24-x)(1600+150x)}$, the solutions are $x = 2$ and $x \approx 11.3$. When $x = 2$, the new price is $22. When $x \approx 11.3$, the new price is about $12.70. The problem states that the price must be greater than $18, so $22 is the answer.

Solution Steps

- To write an equation, use 0.1 for the overhead percent and 4180 for the overhead costs: $0.1 = \frac{4180}{(24-x)(1600+150x)}$.
- Cross multiply to solve the equation. The solutions are $x = 2$ and $x \approx 11.3$.
- Analyze the results. Only $x = 2$ makes sense in the context of the problem.

Career Spotlight: Check

Tips for Completing Exercises 5–8

These tips will help students in solving these exercises and similar assessment items.

Exercise 5

Answer

5. D

Tip Write a general verbal equation that relates the given information. For example, use the following to write an equation:

Operation cost rate for new machine (dollars per hour)	+	Operation cost rate for old machine (dollars per hour)	=	Total operation cost rate (dollars per minute

Exercise 6

Answer

6. B

Tip Eliminate choices that are obviously incorrect. For example, profit margin is the following ratio: $\frac{\text{revenue} - \text{expenses}}{\text{revenue}}$. This format is not used in choice D, so that choice can be eliminated.

Exercise 7

Answer

7. b; a; c; c

Tip Encourage students to keep track of their answers in an organized way. Given the number of choices in this problem, students may write their answer choices down in the wrong order.

Exercise 8

Answer

8. B

Tip Remind students to check the solutions of their equation in the context of the problem.

LESSON 1.1

Solving Equations in One Variable

CAREER PREPARATION: Essential Algebra II Skills

Encourage your students to learn more about these occupations in the Pathway2Careers Career Library.

Lesson Objective

In this lesson, you will learn how to:

- Solve equations with multiple steps.
- Solve equations with variables on both sides of the equal sign.

Career Connections

Vocabulary

- Equation
- Terms
- Coefficient

Prerequisites

- Solving simple algebraic equations

Teaching Support

Algebra II Essentials

Vocabulary equation

Solving Equations Using Addition, Subtraction, Multiplication, or Division

Teaching Strategy If possible, have a balance and show students how taking something from one side will make it unbalanced. What you do to one side of the balance, you must do the same to the other side.

Avoid Common Errors Students may combine like terms across an equal sign without moving the term to the other side. Recommend drawing a line through the equal sign to separate the sides so students know when to combine on one side versus moving to the other side.

When terms that are subtracted are combined with other terms behind them, some students do not know that the subtraction sign can be used as a negative sign.

$12 - 5x + 3x$

Example 1 Solving Equations with Addition, Subtraction, Multiplication, or Division

Build Your Skills: Try Solving Equations with Addition, Subtraction, Multiplication, or Division.

Answers

Solve each equation for x.

1. $x + 2.4 = -5.3$ $x = -7.7$ **2.** $x - 4.1 = 2.9$ $x = 7$

3. $5 + x = 1.5$ $x = -3.5$ **4.** $2.1 - x = -0.9$ $x = 3$

5. $16.12 = 3.1x$ $x = 5.2$ **6.** $\frac{x}{-4.6} = 8.3$ $x = -38.18$

7. $-4.5x = 10$ $x = \frac{-20}{9}$ **8.** $-0.7 = \frac{x}{-7}$ $x = 4.9$

Solving Equations with Multiple Steps

Example 2 Solving Equations with Multiple Steps

Build Your Skills: Try Solving Equations with Multiple Steps

Answers

Solve each equation for x.

9. $-5x + 6 = -12$ $x = 3.6$ **10.** $2(x - 5.3) = 11.7$ $x = 11.15$

11. $5 + 7x = 1.5$ $x = -0.5$ **12.** $9(-4 - x) = .09$ $x = -4.01$

Algebra II Essentials

Use Tools Have students use different-colored highlighters or colored pencils to identify which terms are like terms.

Vocabulary

Term – a single mathematical expression. It may be a single number or variable. It may have multiplication or division, but never addition or subtraction.

Coefficient – a numerical or constant multiplied by the variable

Solving Equations with Variables on Both Sides of The Equation

Example 3 Solving Equations with Variables on Both Sides of the Equation

Build Your Skills: Try Solving Equations with Variables on Both Sides

Solve for x.

13. $3(x+9)=2x-5$ $x=-32$

14. $-12x+8=3x-27$ $x=\frac{7}{3}$

15. $2(3x-2)=-4+12x$ $x=0$

16. $16-2x=3x+10$ $x=1.2\ or\ \frac{6}{5}$

Algebra II Essentials

Teaching Strategy In single-variable equations, when an equation gives a true statement, all real numbers will work that equation.

Solving Equations with No Solution or All Real Numbers

Example 4 Solving Equations with no Solution or All Real Numbers

Build Your Skills: Try Solving Equations with No Solution or All Real Numbers

17. $8 + 5x = 5(1 + x)$ no solution

18. $28 + 5x = 8 + 5(x + 4)$ all real numbers

19. $6.01 + 6.1x = 6.1(x + 2.1) - 6.8$ all real numbers

20. $-1.92 + 6.8x = 8.5(0.8x + 2.4)$ no solution

Career Preparation: Practice

Solve the equation. Check your solution.

1. $15 = 3x + 9$ $x = 2$

2. $\frac{13}{4}x - \frac{7}{5}x = -\frac{82}{25} - \frac{9}{4}x$ $x = \frac{-4}{5}$

3. $24.25 - 5.9x = -1.8(6.4 + 6x)$ $x = -7.3$

4. $3.5x - 14 = -1.5(x - 5.2)$ $x = 4.36$

5. $1.2(3.2 + 6x) = -4.28 - 4.4x$ $x = -0.7$

6. $-16.59 - 5.6x = 4 + 1.5x$ $x = -2.9$

7. $-196 = -7(5x - 2)$ $x = 6$

8. $8x - 12 = 2(4x - 6)$ all real numbers

9. $6(x - 6) + 2(1 + x) = 14$ $x = 6$

10. $\frac{15}{28} = -\frac{11}{7}x + \frac{9}{7}x$ $x = -\frac{15}{8}$

11. $7.1x - 5.03 = 1.9(x - 2.1) + 2.6(2x - 0.4)$ all real numbers

12. $7 - 8x + 7x = 11$ $x = -4$

13. $2(-5x + 8) = 4(x - 8) - 8$ $x = 4$

14. $5x + 16 = -2(x - 4) + 5$ $x = -\frac{3}{7}$

15. Which of the following have no solution?

a. $3x - 5 = 3x + 5$ **b.** $-5x + 7 = 7 - 5x$ **c.** $2(x - 6) = 2x + 6$

d. $2x - 5 = x + 3$ **e.** $-2(x + 5) = x + 5$ **g.** $-9(2x - 4) + 2 = 38 - 18x$

a,c

16. Which of the above have a solution that works for all real numbers? b, g

17. **ERROR ANALYSIS** Explain and correct the error that you find when solving this equation.

$$11.14 - 2x = 3x - 3 + 8$$
$$11.14 - 2x = 3x - 11$$
$$11.14 - 5x = -11$$
$$-5x = -22.14$$
$$x = 4.428$$

From line one to line two, −3 + 8 = 5 not −11.

$$11.14 - 2x = 3x - 3 + 8$$
$$11.14 - 2x = 3x + 5$$
$$11.14 - 5x = 5$$
$$-5x = -6.14$$
$$x = 1.228$$

18. **WRITING** Explain how you know when an equation has a solution, no solution, or infinitely many solutions..

An equation with a solution will solve to x = a number.

An equation with no solution when solved will not have a variable and will be a false statement.

An equation with a solution of all real numbers will not have a variable and will be a true statement.

Use It On the Job

19. Andrea is a carpenter that has a budget of $1,000 for a job. Each 2x4 piece of lumber costs $8.38. She currently has 15 2x4s in her inventory that she can use for the job. How many more 2x4s can she purchase if she wants to stay $1 per 2x4 below budget for incidentals? Solve the equation $8.38(x + 15) = 1000 - 1x$ to determine how many 2x4s she should purchase where *x* is the number of 2x4s.

$x = 93.2$, but you cannot buy a partial board. To stay under budget, round down to 93 boards.

20. Tarlo is a food service manager taking inventory of his supplies. He knows in the next month, wedding cakes will be in high demand. He currently has 50 cakes on order, and each cake will take 11.5 cups of flour. He has 32.2 cups of flour in his inventory. He wants to have enough flour to make an additional 15 cakes. How much flour should he order? Solve the equation $11.5x + 32.2 = 11.5(50 + 15)$ where x is the amount of flour he needs to order.

62.2 cups of flour

Career Preparation: Check

1. Which of the following is a solution to the equation $x + 8x = -18$?

A. 10 **C.** -2

B. -7 **D.** 16

2. Solve: $\frac{-361}{49} - \frac{7}{2}x = \frac{11}{7}x - \frac{11}{7}$.

A. no solution. **C.** $3\frac{3}{7}$

B. $-\frac{8}{7}$ **D.** $-\frac{8}{9}$

3. Solve: $5x + 12 = 3(2x + 9)$.

A. no solution **C.** all real numbers

B. -39 **D.** -15

4. What is the first step in solving the equation $3x - 8 = 2(x + 14)$?

A. subtract 2*x* from each side.

B. add 8 to both sides

C. distribute the 2 into the parenthesis

D. subtract 8 from both sides

5. Solve: $-5.8x - 9.79 = -0.76 - 3.7x$.

A. 3.55 **C.** -4.3

B. All real numbers **D.** 8.1

6. Which equations are equivalent to $15(x - 4) + 7 = 2.5x - 18$?

A. $15x - 4 + 7 = 2.5x - 18$

B. $15x - 60 + 7 = 2.5x - 18$

C. $15x + 3 = 2.5x - 18$

D. $15x - 53 = 2.5x - 18$

E. $17.5x + 3 = -18$

F. $12.5x - 53 = -18$

G. $12.5x = 35$

Use It On the Job

7. Aponi is a Travel Guide. She charges $55 per person for a driving tour. Gas costs $3.24 per gallon. Her van gets 14 miles per gallon. The driving tour is a total of 5 hours, averaging 35 mph. Each passenger also costs her $5 for incidentals, but tip her on average $2 per passenger. If she made $479.50 on the trip, how many passengers did she have?

A. 12 **B**. 10

C. 8 **D.** 6

8. Tomás is a tree trimmer. He charges $435 to trim a large tree. Gas for his vehicle costs on average $50/day for travel. He wants to earn $1,000 per day, plus an additional $14 per tree for gas for his chainsaw. This situation can be represented by the equation $435x - 50 = 1000 + 14x$ where *x* is the number of trees trimmed. How many large trees does he need to trim per day? (Round to the nearest tenth.)

How many large trees does he need to trim?

A. 3 trees **B.** 2.1 trees

C. 2.3 trees **D.** 2.5 trees

LESSON 1.1

Solving Equations in One Variable

CAREER PREPARATION: Essential Algebra II Skills

Did you know?

Carpenters use linear equations to calculate to cost of their materials.

Consider this situation…

A carpenter is framing a house. Nails cost on average $0.05. How many nails can the carpenter buy if he has a budget of $600?

1. Let x represent the number of nails the carpenter needs to purchase.
2. Write an equation to represent the situation.

   $0.05x = 600$

3. Solve for x.

   $\frac{0.05x}{0.05} = \frac{600}{0.05}$ Divide both sides by 0.05

   $x = 12{,}000$

4. Interpret the results. The carpenter will have 12,000 nails.

In this lesson, you will learn how to solve multiple steps linear equations.

Lesson Objective

In this lesson, you will learn how to:

- Solve equations with multiple steps.
- Solve equations with variables on both sides of the equal sign.

Algebra II Essentials

An **equation** is a statement that sets two algebraic expressions equal. Equations have equal signs, =, expressions do not.

To solve an equation means to find the value of the variable that make the equation true.

Solving multi-step equations involves using properties of equality to keep an equation balanced.

(Remember: What you do to one SIDE of the equation, you must do to the other SIDE).

Property	Description
Addition Property of Equality	Adding the same number to each side of an equation produces an equivalent equation. If $a = b$, then $a + c = b + c$.
Subtraction Property of Equality	Subtracting the same number from each side of an equation produces an equivalent equation. If $a = b$, then $a - c = b - c$.
Multiplication Property of Equality	Multiplying each side of an equation by the same nonzero number produces an equivalent equation. If $a = b$ and $c \neq 0$, then $ac = bc$.
Division Property of Equality	Dividing each side of an equation by the same nonzero number produces an equivalent equation. If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.
Distributive Property of Equality	Multiplying the same number into a parentheses group produces an equivalent equation. $a(b + c) = ab + ac$ $(b + c)a = ba + ca$ $a(b - c) = ab - ac$ $(b - c)a = ba - ca$

Solving Equations Using Addition, Subtraction, Multiplication, or Division

Example 1 Solving Equations with Addition, Subtraction, Multiplication, or Division

a. Solve $x - 4.8 = 6.5$.

Solution

Step 1: $x - 4.8 = 6.5$
$+4.8 \quad +4.8$

Since 4.8 is being *subtracted*, use the *Addition* Property of Equality.

$x = 11.3$

Step 2: Check your solution.

$x - 4.8 = 6.5$ — Write original equation.

$(11.3) - 4.8 \stackrel{?}{=} 6.5$ — Substitute 11.3 for *x*.

$6.5 = 6.5$ ✓

Since substituting 11.3 for x in the equation x − 4.8 = 6.5 results in a true statement, 11.3 is the solution for the equation.

b. Solve $-2.1x = 6.72$.

Solution

Step 1: $-2.1x = 6.72$
$\frac{}{-2.1} \quad \frac{}{-2.1}$

Since −2.1 is being *multiplied*, use the *Division* Property of Equality

$x = -3.2$

Step 2: Check your solution.

$-2.1x = 6.72$ — Write original equation.

$-2.1(-3.2) \stackrel{?}{=} 6.72$ — Substitute −3.2 for *x*

$6.72 = 6.72$ ✓

Build Your Skills: Try Solving Equations with Addition, Subtraction, Multiplication, or Division.

Solve each equation for x.

1. $x + 2.4 = -5.3$ **2.** $x - 4.1 = 2.9$

3. $5 + x = 1.5$ **4.** $2.1 - x = -0.9$

5. $16.12 = 3.1x$ **6.** $\frac{x}{-4.6} = 8.3$

7. $-4.5x = 10$ **8.** $-0.7 = \frac{x}{-7}$

Did you know?

Financial Analysts use linear equations to balance accounts.

Solving Equations with Multiple Steps

Example 2 Solving Equations with Multiple Steps

a. Solve $2x - 2.8 = -15.7$.

Solution

Step 1: $2x - 2.8 = -15.7$
$+2.8 \quad +2.8$
$2x = -12.9$

Addition Property of Equality

Step 2: $\frac{2x}{2} = \frac{-12.9}{2}$
$x = -6.45$

Division Property of Equality

Step 3: Check your solution.

$2x - 2.8 = -15.7$ Write original equation.

$2(-6.45) - 2.8 \stackrel{?}{=} -15.7$ Substitute -6.45 for x.

$-15.7 = -15.7$ ✓

b. Solve $3(21x + 14) = 18$

Solution

Step 1: $3(21x + 14) = 18$ — Distributive Property

Step 2: $63x + 42 = 18$
$-42 \quad -42$ — Subtraction Property of Equality

Step 3: $\frac{63x}{63} = \frac{-24}{63}$
$x = \frac{-24}{63}$ — Division Property of Equality

Step 4: $x = \frac{-8}{21}$ — Simplify the fraction

Step 5: Check your solution.

$3(21x + 14) = 18$ — Write original equation.
$3\left(21\left(\frac{-8}{21}\right) + 14\right) \stackrel{?}{=} 18$ — Substitute $\frac{-8}{21}$ for *x*.
$18 = 18$ ✓

Build Your Skills: Try Solving Equations with Multiple Steps

Solve each equation for *x*.

9. $-5x + 6 = -12$ **10.** $2(x - 5.3) = 11.7$

11. $5 + 7x = 1.5$ **12.** $9(-4 - x) = .09$

Did you know?

Food service managers use linear equations to determine how much of each ingredient to stock.

Algebra II Essentials

To solve equations with variables on both sides of the equation, use the properties of equality from above.

Like terms are terms separated by addition or subtraction signs that have the exact same variable and exponent. The **coefficient** (number the variable is multiplied by) may or may not be the same.

Like Terms:	Not Like Terms:
$15x^2$ and $-4x^2$	$5x$ and $12xy$
$-5x$ and $3x$	$-17x$ and x^2
$12xy$ and $12xy$	$-12x$ and $-12y$

The two main steps in solving equations with variables on both sides are:

Step 1: Isolate the variable terms on the left side of the equation using the properties of equality. Collect all terms without a variable on the right side of the equation.

Step 2: Isolate the variable on the left side using the properties of equality.

Solving Equations with Variables on Both Sides of The Equation

Example 3 Solving Equations with Variables on Both Sides of the Equation

Solve the equation for *x*.

a. $5x + 3 = 12x - 5$

Solution

Step 1: $5x + 3 = 12x - 5$
$-12x \quad -12x$ Subtraction Property of Equality

Step 2: $-7x + 3 = -5$
$-3 \quad -3$ Subtraction Property of Equality

Step 3: $\frac{-7x}{-7} = \frac{-8}{-7}$ Division Property of Equality
$x = \frac{8}{7}$

Step 4: Check your solution.
$5x + 3 = 12x - 5$ Write original equation.
$5\left(\frac{8}{7}\right) + 3 \stackrel{?}{=} 12\left(\frac{8}{7}\right) - 5$ Substitute $\frac{8}{7}$ for *x*.
$\frac{61}{7} = \frac{61}{7}$ ✓

Solve the equation for *x*.

b. $\mathbf{-1.4(x + 5.9) - 2.2 = -26.93 + 1.3x}$

Solution

Step 1: $-1.4(x + 5.9) - 2.2 = -26.93 + 1.3x$ Distributive Property

Step 2: $-1.4x - 8.26 - 2.2 = -26.93 + 1.3x$ Combine Like Terms

Step 3: $-1.4x - 10.46 = -26.93 + 1.3x$
$-1.3x \qquad -1.3x$ Subtraction Property of Equality

Step 4 $-2.7x - 10.46 = -26.93$
$+10.46 \quad +10.46$ Addition Property of Equality

Step 5: $\frac{-2.7x}{-2.7} = \frac{-16.47}{-2.7}$ Division Property of Equality
$x = 6.1$

Step 6: Check your solution.
$-1.4(x + 5.9) - 2.2 = -26.93 + 1.3x$ Rewrite original equation.
$-1.4(6.1 + 5.9) - 2.2 \stackrel{?}{=} -26.93 + 1.3(6.1)$ Substitute 6.1 for x.
$-19 = -19$ ✓

Build Your Skills: Try Solving Equations with Variables on Both Sides

Solve for *x*.

13. $3(x+9) = 2x - 5$

14. $-12x + 8 = 3x - 27$

15. $2(3x - 2) = -4 + 12x$

16. $16 - 2x = 3x + 10$

Did you know?

That travel agents use linear equations to create budgets for vacations.

Algebra II Essentials

Sometimes, when solving an equation, the final step results in a statement with no variable. These equations will either have no solution, or any number would work.

Equations that have no solution will result in a false statement when solved.

For example: After solving, the equation is 5 = 2. This is a false statement because 5 does not equal 2, so there is no solution.

Equations in which any number would work will result in a true statement when solved.

For example: After solving, the equation is 3 = 3. This is a true statement because 3 does equal 3, so any number for the variable would satisfy the original equation or all real numbers is the solution set.

Solving Equations with no Solution or All Real Numbers

Example 4 Solving Equations with no Solution or All Real Numbers

Solve the equation for x.

a. $5x - 13 = 5x + 3$

Solution

Step 1: $5x - 13 = 5x + 3$
$-5x \quad -5x$ Subtraction Property of Equality
$-13 = 3$

Step 2: Interpret results: Since the final answer does not have a variable and the equation is a false statement, there is no solution.

Solve the equation for x.

b. $-2(x + 5) = -2x - 10$

Solution

Step 1: $-2(x + 5) = -2x - 10$ Distributive Property

Step 2: $-2x - 10 = -2x - 10$
$+2x \quad +2x$ Addition Property of Equality
$-10 = -10$

Step 3: Interpret results: Since the final answer does not have a variable and the equation is a true statement, the solution to the equation would be all real numbers since any value of the variable would satisfy the equation.

Build Your Skills: Try Solving Equations with no Solution or All Real Numbers

17. $8 + 5x = 5(1 + x)$

18. $28 + 5x = 8 + 5(x + 4)$

19. $6.01 + 6.1x = 6.1(x + 2.1) - 6.8$

20. $-1.92 + 6.8x = 8.5(0.8x + 2.4)$

Career Preparation: Practice

Solve the equation. Check your solution.

1. $15 = 3x + 9$

2. $\frac{13}{4}x - \frac{7}{5}x = -\frac{82}{25} - \frac{9}{4}x$

3. $24.25 - 5.9x = -1.8(6.4 + 6x)$

4. $3.5x - 14 = -1.5(x - 5.2)$

5. $1.2(3.2 + 6x) = -4.28 - 4.4x$

6. $-16.59 - 5.6x = 4 + 1.5x$

7. $-196 = -7(5x - 2)$

8. $8x - 12 = 2(4x - 6)$

9. $6(x - 6) + 2(1 + x) = 14$

10. $\frac{15}{28} = -\frac{11}{7}x + \frac{9}{7}x$

11. $7.1x - 5.03 = 1.9(x - 2.1) + 2.6(2x - 0.4)$

12. $7 - 8x + 7x = 11$

13. $2(-5x + 8) = 4(x - 8) - 8$

14. $5x + 16 = -2(x - 4) + 5$

15. Which of the following have no solution?

a. $3x - 5 = 3x + 5$

b. $-5x + 7 = 7 - 5x$

c. $2(x - 6) = 2x + 6$

d. $2x - 5 = x + 3$

e. $-2(x + 5) = x + 5$

g. $-9(2x - 4) + 2 = 38 - 18x$

16. **THINK ABOUT IT** Which of the above have a solution that works for all real numbers?

17. **ERROR ANALYSIS** Explain and correct the error that you find when solving this equation.

$$11.14 - 2x = 3x - 3 + 8$$
$$11.14 - 2x = 3x - 11$$
$$11.14 - 5x = -11$$
$$-5x = -22.14$$
$$x = 4.428$$

18. **WRITING** Explain how you know when an equation has one solution, no solution, or infinitely many solutions.

Use It On the Job

19. Andrea is a carpenter who has a budget of $1,000 for a job. Each 2x4 piece of lumber costs $8.38. She currently has 15 2x4s in her inventory that she can use for the job. How many more 2x4s can she purchase if she wants to stay $300 below budget for incidentals? Solve the equation $8.38(x + 15) = 1000 - 300$ to determine how many 2x4s she should purchase.

20. Tarlo is a food service manager taking inventory of his supplies to have enough product in stock to meet the demand. He knows in the next month, wedding cakes will be in high demand. He currently has 50 cakes on order, and each cake will take 11.5 cups of flour. He has 32.2 cups of flour in his inventory. He wants to have enough flour to make an additional 15 cakes. How much flour should he order? Solve the equation. $11.5x - 32.2 = 11.5(50 + 15)$ where x is the amount of flour he needs to order.

Career Preparation: Check

1. Which of the following is a solution to the equation $x + 8x = -18$?

A. 10 **C.** -2

B. -7 **D.** 16

2. Solve: $\frac{-361}{49} - \frac{7}{2}x = \frac{11}{7}x - \frac{11}{7}$.

A. no solution. **C.** $3\frac{3}{7}$

B. $-\frac{8}{7}$ **D.** $-\frac{8}{9}$

3. Solve: $5x + 12 = 3(2x + 9)$.

A. no solution **C.** all real numbers

B. -39 **D.** -15

4. What is the first step in solving the equation $3x - 8 = 2(x + 14)$?

A. subtract 2*x* from each side

B. add 8 to both sides

C. distribute the 2 into the parenthesis

D. subtract 8 from both sides

5. Solve: $-5.8x - 9.79 = -0.76 - 3.7x$.

A. 3.55 **C.** -4.3

B. All real numbers **D.** 8.1

6. Which equations are equivalent to $15(x - 4) + 7 = 2.5x - 18$?

A. $15x - 4 + 7 = 2.5x - 18$

B. $15x - 60 + 7 = 2.5x - 18$

C. $15x + 3 = 2.5x - 18$

D. $15x - 53 = 2.5x - 18$

E. $17.5x + 3 = -18$

F. $12.5x - 53 = -18$

G. $12.5x = 35$

Use It On the Job

7. Aponi is a Travel Guide. She charges $55 per person for a driving tour. Gas costs $3.24 per gallon. Her van gets 14 miles per gallon. The driving tour is a total of 5 hours, averaging 35 mph. Each passenger also costs her $5 for incidentals, but tip her on average $2 per passenger. If she made $479.50 on the trip, how many passengers did she have?

A. 12 **B**. 10

C. 8 **D.** 6

8. Tomás is a tree trimmer. He charges $435 to trim a large tree. Gas for his vehicle costs on average $50/day for travel. He wants to earn $1,000 per day, plus an additional $14 per tree for gas for his chainsaw. This situation can be represented by the equation $435x - 50 = 1000 + 14x$ where x is the number of trees trimmed. How many large trees does he need to trim per day? (Round to the nearest tenth.)

How many large trees does he need to trim?

A. 3 trees **B.** 2.1 trees

C. 2.3 trees **D.** 2.5 trees