Unit 4
The TransAmerica Pyramid: Spatial Visualization

Standards

The student will:

9.3 Find lateral area and total area of selected solids, including prisms, pyramids, cylinders, and cones.
9.4 Find volume of prisms, pyramids, cylinders, and spheres.

Algebra I

6.10 Solve equations by factoring.
7.7 Graph equations of the form $y = ax^2 + bx + c$, where a, b, c are real numbers.

Day 1
Introduction to Quadratic Functions

Connections

Prior Work	Current Big Idea	Future Work
• Graph sets of ordered pairs on the coordinate system. • Find perimeter and area for given rectangles.	• Graph equations of the form $y = ax^2 + bx + c$, where a, b, and c are real numbers.	• Graph quadratic equations.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	Complete SV-1 with teacher and class.	• Complete SV-1 with students. • Be sure students draw several different rectangles on graph paper so that they can visualize what is going on.	• The work appears to be rather long, but it moves quickly if students are kept on task.
Explore 20-25 minutes	• Complete SV-2 through SV-8 with study team.	• Students need to 'connect ' the points of the graph with 'curve' rather than segments.	• The term 'function' is used without a formal definition.
Summarize 10-15 minutes	• Share conclusions for SV-6 with class.	• Select study teams to share conclusions for SV-6 with class. • Emphasize that quadratic equations for parabolas contains only one quadratic term.	

Steps	Student Activity	Teacher Support	Comment/Evaluation
Homework	• SV-9 throughSV-13.	SV-9 is review of Algebra I.	

Day 2
Graphing Non-Linear Inequalities
(Optional)

Connections

Prior Work	Current Big Idea	Future Work
• Sketch graphs for given parabolas.	• Graph inequalities involving parabolas.	• Graph quadratic inequalities.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Complete SV-14 and SV-15with teacher and class.	• Complete SV-14 and SV-15 with students. • Show the concrete relationship between the factored form of a quadratic and its roots. • The language of “where the curve crosses the x-axis” may be used.	
Explore 20-25 minutes	• Complete SV-16 through SV19 with study team.	• Quadratics in the exercises will appear in factored form. • Emphasize the fact that the roots are where the curve crosses the x-axis.	
Summarize 8-10 minutes	• Share Solution to SV-18 with class.	• Select study team to share SV-18 with class.	

Steps	Student Activity	Teacher Support	Comment/Evaluation
Homework	• SV-20 through SV-24.		

Day 3
Visualizing, Part 1

Connections

Prior Work	Current Big Ideas	Future Work
• Visualization activities.	• Seeing figures through different perspectives.	• Visualization of 3-dimensional objects through 2-dimensional representations.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Describe and discuss figures shown by teacher.	• Show 'optical illusion' pictures to start class discussion.	
Explore 20-15 minutes	• Complete SV-25 through SV-34 with study team.	• Add other optical illusions for students to share and discuss. • Many 'optical illusion' books are available in the media center. • Provide centimeter square graph paper and scissors so students may make construct the nets needed for making cubes for SV-32 through SV-34.	• Encourage students to see diagrams and figures from various perspectives.
Summarize	• Share discussions of SV-25 through SV-34 with class.	• Select study teams to share discussions of SV-25 through SV-34	

Steps	Student Activity	Teacher Support	Comment/Evaluation
8-10 minutes		with class.	
Homework	SV-36 through SV-38.		

Day 4
Visualization, Part 2

Connections

Prior Work	Current Big Idea	Future Work
• Visualization activities.	• Seeing figures through different perspectives.	• Visualization of 3-dimensional objects through 2-dimensional representations.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Complete SV-40 with teacher and class.	• Use geometric solids, such as spheres, cylinders, rectangular prisms, or cones. Ask students to describe and sketch the geometric shapes they see as they view the solids from different perspectives. • Solid figures may be put on the overhead so that students may see the silhouettes of the shapes from different perspective.	• Good source book is "Seeing Solids and Silhouettes" from the 4th grade Investigations in Number, Data, and Space.
Explore 20-25 minutes	• Complete SV-41 through SV-43 with study team.	• Provide students with string and thumbtacks or stickpin to facilitate the visualization and demonstration of tSV-41 through SV-42.	

Steps	Student Activity	Teacher Support	Comment/Evaluation
Summarize 8-10 minutes	• Discussion of SV-44 with teacher and class.	• Although vertices and edges are not defined until day 7, students should be familiar with the terminology.	
Homework	• SV-47 through SV-52.		

Day 5
Isometric Drawings

Connections

Prior Work	Current Big Idea	Future Work
• Visualization of 3-dimensional objects.	• Isometric drawings of cubes.	• Solve systems of linear equations in three variables.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Follow teacher in constructing isometric drawings of cubes.	• Brief discussion of SV-53. • Demonstrate drawing of cubes on isometric dot paper.	• Many students have experienced using isometric dot paper.
Explore 20-25 minutes	• Complete SV-25 through SV 59 with study team.	• Provide students with cubes. • Encourage students to build models with the cubes before starting the drawings.	• Reading "Seeing Solids and Silhouettes" from the 4th grade *Investigations in Number, Data, and Space* will provide insight to helping students in completing drawing.
Summarize	• Share drawings with class.	• Share and discuss various drawings.	

Steps	Student Activity	Teacher Support	Comment/Evaluation
8-10 minutes			
Homework	• SV-62 through SV-64.		

Day 6
Mat Plans for Isometric Drawings

Connections

Prior Work	Current Big Idea	Future Work
• Complete drawings of cubes on isometric dot paper.	• Construct Mat Plans for isometric drawings of cubes. • Definitions for volume and prism,	• Solve problems related to volume of geometric solids.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Follow teacher's explanation on using Mat Plans.	• Introduce the use of placing constructed models on index cards and looking for front, right, and top of the models. • Models may be turned easily with the use of the index card and viewed from several directions without it falling apart.	• Do not spend time to see that all students understand the construction of Mat Plans.
Explore 20-25 minutes	• Complete SV-66 through SV-73 with study team.	• Students need much individual help in visualizing and constructing Mat Plans for models. • SV-67 defines volume. • SV-71 defines prism.	• If students find that the Mat Plans are difficult, complete two or three demonstrations and let it go.

Steps	Student Activity	Teacher Support	Comment/Evaluation
Summarize 8-10 minutes	• Discuss and share Mat Plans for SV-66 through SV-73.	• Select study teams to present Mat Plans for SV-66 through SV-73.	
Homework	• SV-74, SV-75, SV-77, SV-78.		

Day 7
Polyhedra and Surface Area

Connections

Prior Work	Current Big Idea	Future Work
• Find areas of triangles and quadrilaterals. • Visualization of 3-dimensional figures.	• Determine the number of edges, vertices, and faces for given polyhedrons.	• Find surface area and volume for specified polyhedrons.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 8-10 minutes	• Complete part (a) of SV-79 with teacher and class.	• Complete part (a) of SV-79 with class. • Identify edges, and vertices of constructed polyhedron. • Use tetrahedron, completed from template, to identify the faces.	• Many students need the experience of constructing models in order to visualize the figures.
Explore 20-25 minutes	Complete SV-79 throughSV-83 with study team.	• Guide students in recording the data on vertices, edges, and faces in proper format for ease of finding patterns.	• Do not let students spend a good deal of time constructing 'nice' models. The idea of constructing the models is to provide tool for visualization.
Summarize	• Discuss SV-83 with teacher and class. • Add definition of polyhedron to toolkit.	• Discuss SV-83 with class. • Use conter-examples.	• It is not important that students memorize all the

Steps	Student Activity	Teacher Support	Comment/Evaluation
8-10 minutes	• Complete SV-84 with class.		names of the polyhedrons. • 4, 8, 10, and 12 faces are the most commonly used.
Homework	• SV-85 throughSV-90.		

Day 8
Drawing Polyhedra

Connections

Prior Work	Current Big Idea	Future Work
• Represent cubes using isometric dot paper.	• Drawing and visualizing hidden vertices and edges of polyhedrons.	• Find surface area and volume for given polyhedrons.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Follow teacher's demonstration for SV-91.	• Demonstrate SV-91.	• Many students find it difficult to visualize hidden parts of 3-dimensional object.
Explore 20-25 minutes	• Complete SV-91 through SV-95 with study team.	• Construct hexagonal prism and pyramid from resource pages for demonstration.	
Summarize 8-10 minutes	• Discussion of SV-95 with class.	• Select study teams to discus SV-95 with class.	
Homework	• SV-97 through SV-100.	• Students may need help for SV-100.	

Day 9
Surface Area

Connections

Prior Work	Current Big Idea	Future Work
• Find areas of triangles and quadrilaterals. • Identify faces for given polyhedrons.	• Find surface area for given polyhedrons.	• Solve real-world problems related to geometric solids.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Complete SV-101, part (a).	• Demonstrate part (a) for SV-101.	•
Explore 20-25 minutes	• Complete SV-101 through SV-104 with study team.	• SV-104 requires the use of radicals. Students may need help in visualizing the conditions of the problems. • Guide students in creating a diagram and breaking the problem into sub-problems.	•
Summarize 8-10 minutes	• Share solution for SV-104 with class.	• Select study teams to present solution for SV-104 with class. • If time permits, start SV-105 with class.	•

Steps	Student Activity	Teacher Support	Comment/Evaluation
Homework	• SV-105 through SV-107.		•

Day 10
Review

Connections

Prior Work	Current Big Idea	Future Work
• Find surface area and volume for given polyhedrons.	• Review of Unit 4.	• Solve real world problems related to surface area and volume for given polyhedrons.

Lesson Process

Steps	Student Activity	Teacher Support	Comment/Evaluation
Launch 10-15 minutes	• Start SV-117, toolkit checkup, with teacher.	• Start students with SV-117, toolkit checkup.	
Explore 20-25 minutes	• Complete SV-109 through SV117 with study team.	• SV-114 is optional.	
Summarize 8-10 minutes	• Share solutions from SV-109 through SV-117 with class.	• Select study teams to share SV-109 through SV117 with class.	
Homework	Review Unit 4.		