Title	Stars Are Not Pointless
Creator:	Reger, Neil nreger@access.k12.wv.us
Source:	2009 TLI Staff PBL Plans
Project Idea:	You are engineers working for Architect Designs & Innovations. A major competitor claims that their n-point, 3-dimensional stars are more aesthetically pleasing than other stars on the market. After purchasing several stars from the major competitor and analyzing their shape and design, the research department of your company found that the Golden Ratio is not present in the shape of their stars. Your graphics art department concluded that incorporating the Divine Proportion into the shape and design of the stars would increase the aesthetic beauty, thus surpassing that of the competitor's stars. Your potential customers would be asked to provide the radius and number of points they desire in their 3-dimensional star. Prepare a presentation to the design branch of Architect Designs & Innovations that includes detailed drawings, derivation of all formulas and numerical justifications of formulas for two different stars. Your drawings need to show the use of the Golden Ratio, the radius of the star, the horizontal distance (on the wall) from the center of the star to the vertex of the interior angles (interior radius), the measure of the interior angle between the points of the star, the measure of the angle at the tip of each point (on the wall), the height of the star at the center (distance from the wall at the center), the measures of the angles of each triangular face and the lengths of sides of each triangular face. You should also develop formulas to find the area of each triangular face and the total area of the triangular faces. To minimize cost, each triangular section of the star will be a separate piece punched from a rectangular sheet of material and assembled in the factory. Your presentation should include the procedure to find the dimensions of the rectangular sheet with the least area needed to construct the star. Provide sound mathematical evidence for each detail.
Entry Event:	Invite a representative from a local decorations and/or architectural design businesses to initiate student interest by sharing his knowledge about using the golden ratio in art, decorations and architectural design. Provide the representative with the following ideas to guide their presentation. Discuss the Golden Ratio in nature. Discuss using the Golden Ratio in art, decorations and architectural design. Look at **Golden Ratio Resources**. Discuss how Country Stars can be found all over the nation. Look at **Pictures of Country Stars**.

Content Standards & Objectives:

Objectives Directly Taught or Learned Through Discovery	Identified Learning Target	Evidence of Success in Achieving Identified Learning Target
M.O.T.3.8 investigate real-world problems within a project based investigation involving triangles using the trigonometric functions, the law of sines and the law of cosines, justify and present results.	Know the law of sines. Know the law of cosines. Know the definitions that relate the trigonometric functions to the sides of a right triangle Recognize a real-world situation that can be modeled by a triangle. Choose the appropriate method to solve a given triangle. Find all the missing parts of a triangle. Make a drawing to represent the situation. Use trigonometric functions, the law of sines or the law of cosines to investigate a real-world situation involving triangles and prepare a presentation to justify the results.	Activity sheets from "Discovering Formulas to Solve Oblique Triangles" Notes from "Investigating Formulas to Solve and Find the Area of Oblique Triangles" Activity sheet from "Explore Oblique Triangles for the SAS case" Response sheet from "Explore Oblique Triangles for the SSA case" **2-D Silhouette Example** **3-D Example** **Demonstrating and Applying the Derived Formulas**

	M.O.T.3.9 develop and test a hypothesis to find the area of a triangle given the measures of two sides and the included angle or the measures of three sides (Heron??s formula) and use these formulas to find total area of figures constructed of multiple shapes.	Know Heron's formula. Know the formulas to find area of a triangle given SAS, AAS or ASA. Determine the appropriate formula. Determine how to separate a figure into multiple shapes to find the area. Use the appropriate formula to find the area of a triangle. Use the appropriate formulas to find the area of figures.	Activity sheets from "Discovering Formulas to Solve Oblique Triangles" Notes from "Investigating Formulas to Solve and Find the Area of Oblique Triangles" Activity sheet from "Explore Oblique Triangles for the SAS case" Response sheet from "Explore Oblique Triangles for the SSA case" **3-D Example** **Demonstrating and Applying the Derived Formulas** **Project Scenario**

21st Century Skills	Learning Skills & Technology Tools	Teaching Strategies Culminating Activity	Evidence of Success
Information and Communication Skills:	21C.O.9-12.1.LS1 - Student recognizes information needed for problem solving, can efficiently browse, search and navigate online to access relevant information, evaluates information based on credibility, social, economic, political and/or ethical issues, and presents findings clearly and persuasively using a range of technology tools and media. 21C.O.9-12.1.LS3 - Student creates information using advanced skills of analysis, synthesis and evaluation and shares this information through a variety of oral, written and multimedia communications that target academic, professional and technical audiences and purposes. 21C.O.9-12.1.TT5 - Student uses advanced features of word processing software (e.g., outline, table of contents, index feature, draw tool, headers and footers, track changes, macros, hyperlinks to other file formats, etc.).	The teacher will engage students in online demonstrations of the appropriate use of Law of Sines, Law of Cosines, as well as special triangle area formulas. The teacher will provide students the opportunity to make daily journal entries. The teacher will monitor and assist students as they prepare and communicate their findings.	Students search and navigate the Internet to find relevant information related to Law of Sines, Law of Cosines, as well as special triangle area formulas. Students use graphing utilities and drawing software to separate a figure into multiple shapes. Students analyze various methods to solve triangles by using the given parts and determine the appropriate formula. Students communicate their problem solving methods using presentation software. Daily Writing Journal that includes accomplishments and reflections of lessons learned **2-D Silhouette Example** **3-D Example** **Demonstrating and Applying the Derived Formulas**

		The teacher will monitor and assist students as they use advanced features of word processing software in their products.	**Project Scenario**
Thinking and Reasoning Skills:	21C.O.9-12.2.LS3 - Student engages in a problem solving process by formulating questions and applying complex strategies in order to independently solve problems. 21C.O.9-12.2.TT3 - Student uses multiple electronic sources of information and multiple technology tools and resources tools (e.g., digital cameras, graphing calculators, probes, mp3 players, handheld devices, other emerging technologies, simulations, models, browsers, word processing, authoring tools, spreadsheets, databases) to collaborate with others, to formulate a hypothesis, to solve problems, make decisions, and present and justify the solutions. 21C.O.9-12.2.TT4 - Student uses technology tools and multiple media sources to analyze a real-world problem, design and implement a process to assess the information, and chart and evaluate progress toward the solution.	The teacher will provide opportunities for students to separate real-world figures into multiple shapes with and without the use of technology. The teacher will monitor and assist students as they develop problem solving strategies. The teacher will monitor and assist students as use a variety of technology tools to solve problems. The teacher will monitor and assist students as use a variety of technology tools to analyze problems.	Students use manipulatives to model separating a figure into multiple shapes. Students recognize ways to model real-world figures as a composite of multiple triangles. **3-D Example** **Demonstrating and Applying the Derived Formulas** **Project Scenario**
Personal and Workplace Skills:	21C.O.9-12.3.LS2 - Student independently considers multiple perspectives and can represent a problem in more than one way, quickly and calmly changes focus and goals as the situation requires, and actively seeks innovations (e.g. technology) that will enhance his/her work. 21C.O.9-12.3.LS5 - Student exhibits positive leadership through interpersonal and problem-solving skills that	Teacher presents real-world situations and monitors students in collaborative groups as they acquire and evaluate data in a variety of ways. The teacher will monitor and assist students as they work independently to create their products. The teacher will assist students self-monitor their group progress.	Students work in collaborative groups, choose appropriate tools, identify accurate models and evaluate conclusions in problem solving situations. **2-D Silhouette Example** **3-D Example** **Project Scenario** **Demonstrating and Applying the Derived Formulas**

	contribute to achieving the goal. He/she helps others stay focused, distributes tasks and responsibilities effectively, and monitors group progress toward the goal without undermining the efforts of others. 21C.O.9-12.3.TT2 - Student works collaboratively to acquire information from electronic resources, conducts online research, and evaluates information as to validity, appropriateness, usefulness, comprehensiveness and bias. 21C.O.9-12.3.TT8 - Student uses technology to seek strategies and information to address limits in their own knowledge.	The teacher will monitor and assist students as they collaborative on the appropriateness of their information. The teacher will monitor and assist students in their use of technology as they identify and search needed information.	

Performance Objectives:	**Know** Recognize information needed for problem solving Know the Law of Sines and the Law of Cosines Know the definitions that relate the trigonometric functions to the sides of a right triangle Know Heron's formula Know the formulas to find area of a triangle given SAS, AAS or ASA **Do** Find all the missing parts of a triangle Make a drawing to represent a specific example Use the appropriate formula to find the area of a triangle and the area of figures Use technology tools and multiple media sources to analyze a real-world problem Use multiple perspectives and can represent a problem in more than one way Exhibit positive leadership through interpersonal and problem-solving skills that contribute to achieving the goal Work collaboratively to acquire information from electronic resources Engage in a problem solving process by formulating questions and applying complex strategies in order to independently solve problems Use multiple electronic sources of information and multiple technology tools Make informed choices among available advanced technology systems, resources and services Use technology to seek strategies and information to address limits in knowledge Use advanced features of word processing and spreadsheet software Create information using advanced skills of analysis, synthesis and evaluation and shares this information through a variety of oral, written and multimedia communications
Driving Question:	How can trigonometry be used to determine the design requirements of an n-point, 3-dimensional star?
Assessment Plan:	**2-D Silhouette Example**: The foreman of your engineering division is asking each member of your team to construct a 2-D silhouette example (outline of the star by tracing its borders on the wall) of an n-point, 3-dimensional star, to be used as models to check your team?s final formulas. Each member of your team needs to choose the radius and the number of points for their star. To check the integrity of your final formulas, your team members should choose a variety of radii and number of points for their models. Create a spreadsheet that contains the information that will be needed to check your final formulas. Your team must prepare a presentation to your

engineering division that details how each member constructed their star and determined the data values in the spreadsheet.Provide sound mathematical evidence for each detail.

3-D Example: The foreman of your engineering division is asking each member of your team to construct a 3-D example of an n-point, 3-dimensional star that can be placed on their 2-D silhouette example. This model will also be used to check your team?s final formulas. Each member of your team will use the radius and the number of points from their 2-D silhouette example. Add information that will be needed to check your final formulas to your spreadsheet from your 2-D silhouette example. Your team must prepare a presentation to your engineering division that details how each member constructed their star and determined the data values in the spreadsheet.Provide sound mathematical evidence for each detail.

Demonstrating and Applying the Derived Formulas: In only a few days, your engineering team will make their presentation to the design branch of Architect Designs & Innovations, detailing the derivation of formulas, and graphical representations that models the rectangular sheet with least area and the dimensions of an n-point, 3-dimensional star, given the radius and the number of points. The Chief Engineer is requesting from each of you, a persuasive essay that shows the derivation of formulas, demonstrates the use of formulas, shows drawings of your 2-D silhouette example and 3-D example, includes a detailed spreadsheet, and justifies the measures of your 2-D and 3-D examples using the derived formulas.Provide sound mathematical evidence for each detail.

Project Scenario: You are engineers working for Architect Designs & Innovations. A major competitor claims that their n-point, 3-dimensional stars are more aesthetically pleasing than other stars on the market. After purchasing several stars from the major competitor and analyzing their shape and design, the research department of your company found that the Golden Ratio is not present in the shape of their stars. Your graphics art department concluded that incorporating the Divine Proportion into the shape and design of the stars would increase the aesthetic beauty, thus surpassing that of the competitor's stars. Your potential customers would be asked to provide the radius and number of points they desire in their 3-dimensional star. Prepare a presentation to the design branch of Architect Designs & Innovations that includes detailed drawings, derivation of all formulas and numerical justifications of formulas for two different stars. Your drawings need to show the use of the Golden Ratio, the radius of the star, the horizontal distance (on the wall) from the center of the star to the vertex of the interior angles (interior radius), the measure of the interior angle between the points of the star, the measure of the angle at the tip of each point (on the wall), the height of the star at the center (distance from the wall at the center), the measures of the angles of each triangular face and the lengths of sides of each triangular face. You should also develop formulas to find the area of each triangular face and the total area of the triangular faces. To minimize cost, each triangular section of the star will be a separate piece punched from a rectangular sheet of material and assembled in the factory. Your presentation should include the procedure to find the dimensions of the rectangular sheet with the least area needed to construct the star. Provide sound mathematical evidence for each detail.

Major Group Products	**2-D Silhouette Example**: Multimedia presentation that requires creating an organized spreadsheet and justification of numerical values in a two-dimensional model. **3-D Example**: Multimedia presentation that requires updating an organized spreadsheet and justification of numerical values in a three-dimensional model. Culminating Assessment (**Project Scenario**): Multimedia presentation, research summary that requires the use of trigonometry to derive and apply formulas from 2-D and 3-D drawings and/or models.
Major Individual Projects	**Demonstrating and Applying the Derived Formulas**: Persuasive essay that shows the derivation of formulas, demonstrates the use of formulas, shows 2-D and 3-D drawings and/or models, includes a detailed spreadsheet, and justifies the derived formulas to verify measurements in the 2-D and 3-D examples.

Assessment and Reflection:	**Rubric(s) I Will Use:**	Collaboration		Written Communication **Demonstrating and Applying the Derived Formulas Rubric**	X

		Critical Thinking & Problem Solving **2-D Silhouette Example Rubric** **3-D Example Rubric** **Demonstrating and Applying the Derived Formulas Rubric** **Project Scenario Rubric**	X	Content Knowledge **2-D Silhouette Example Rubric** **3-D Example Rubric** **Demonstrating and Applying the Derived Formulas Rubric** **Project Scenario Rubric**	X
		Oral Communication **2-D Silhouette Example Rubric** **3-D Example Rubric** **Project Scenario Rubric**	X	Other	
	Other Classroom Assessments For Learning:	Quizzes/ tests Teacher made quizzes/tests	X	Practice presentations **Practice Presentation Checklist**	X
		Self-evaluation **Architect Designs and Innovations Self-Team Final Evaluation**	X	Notes Individual student notes	X
		Peer evaluation **Architect Designs and Innovations Self-Team Final Evaluation**	X	Checklists/observations **Architect Designs and Innovations Adapted Knowledge Rating Scale** **Vocabulary Development** **Architect Designs and Innovations Checklist**	X
		Online Tests and Exams		Concept Maps	
	Reflections:	Survey **Architect Designs and Innovations Final Evaluation**	X	Focus Group	
		Discussion Essential questions	X	Task Management Chart **Architect Designs and Innovations Checklist**	X
		Journal Writing/ Learning Log Daily Writing Journal that includes accomplishments and a reflection of lessons learned	X	Other **Know-Need to Know Log**	X

Map The Product:

Product: Project Scenario

Knowledge and Skills Needed	Already Have Learned	Taught Before the Project	Taught During the Project
1. Recognize information needed for problem solving		X	
2. Know the law of sines and cosines			X
3. Know the definitions that relate the trigonometric functions to the sides of a right triangle		X	
4. Know Heron's formula			X
5. Know the formulas to find area of a triangle given SAS, AAS or ASA			X
6. Find all the missing parts of a triangle			X
7. Make a drawing to represent a specific example	X		
8. Use the appropriate formula to find the area of a triangle and area of figures			X

	9. Use technology tools and multiple media sources to analyze a real-world problem		X	
	10. Use multiple perspectives and can represent a problem in more than one way	X		
	11. Exhibit positive leadership through interpersonal and problem-solving skills that contribute to achieving the goal		X	
	12. Work collaboratively to acquire information from electronic resources			X
	13. Engage in a problem solving process by formulating questions and applying complex strategies in order to independently solve problems		X	
	14. Use multiple electronic sources of information and multiple technology tools			X
	15. Make informed choices among available advanced technology systems, resources and services			X
	16. Use technology to seek strategies and information to address limits in knowledge			X
	17. Use advanced features of word processing and spreadsheet software			X
	18. Create information using advanced skills of analysis, synthesis and evaluation and shares this information through a variety of oral, written and multimedia communications			X

Resources:

School-based Individuals:
Technology Integration Specialist

Technology:
Computer Lab
Internet Browser with Java enabled
Word Processing Software
Spreadsheet Software
Presentation Center
Resource/Learning Center:
Area Resources
Constructing Stars
Derivations and Proofs of Formulas
Golden Ratio Resources
Law of Cosines
Law of Sines
Oblique Triangle Resources
Pictures of Country Stars
Discovering Formulas to Solve Oblique Triangles:
http://illuminations.nctm.org/Lessons/LawSinesCosines/LawSines-AS-Discover.pdf
http://illuminations.nctm.org/Lessons/LawCosinesGeo/LawCosinesGeo-AS-SquareTriangle.pdf
Investigating Formulas to Solve and Find the Area of Oblique Triangles:
http://www.algebralab.org/studyaids/studyaid.aspx?file=Trigonometry_LawSines.xml
http://www.algebralab.org/studyaids/studyaid.aspx?file=Trigonometry_LawCosines.xml
Explore Oblique Triangles for the SAS case:
http://www.sascurriculumpathways.com -> Mathematics -> Trigonometry -> Triangles: Right & Oblique -> Classroom Activity 1047
Explore Oblique Triangles for the SSA case:
http://www.sascurriculumpathways.com -> Mathematics -> Trigonometry -> Triangles: Right & Oblique -> Web Inquiry 116
Writing a Persuasive Essay:
http://www.studygs.net/wrtstr4.htm

	Community: Representatives from Decorations and/or Architectural Design Businesses **Materials:** Rulers Protractors Compasses Graphing calculator Poster board or other construction material
Manage the Process:	**Project Storyboard**: Allow approximately 5 weeks. Before the project begins: Divide students into teams of 3 or 4 students for major group products and projects. Prepare a Resource/Learning Center for differentiating and tiering. Include the following possible tips or hints (mathematical knowledge students will need to know to complete this project) in the project Resource/Learning Center: **Area Resources** **Constructing Stars** **Derivations and Proofs of Formulas** **Golden Ratio Resources** **Law of Cosines** **Law of Sines** **Oblique Triangle Resources** **Pictures of Country Stars** As a homework assignment at the end of each day, each student will use a word processor to keep a daily writing journal that includes accomplishments and reflections of lessons learned. All entries will be in complete sentences. **Launch the Project**. Driving Question: How can trigonometry be used to determine the design requirements of an n-point, 3-dimensional star? **Entry Event**: Invite a representative from a local decorations and/or architectural design businesses to initiate student interest by sharing his knowledge about using the golden ratio in art, decorations and architectural design. Provide the representative with the following ideas to guide his presentation. Discuss the Golden Ratio in nature. Discuss using the Golden Ratio in art, decorations and architectural design. Look at **Golden Ratio Resources**. Discuss how Country Stars can be found all over the nation. Look at **Pictures of Country Stars**. Distribute the **Project Scenario** to each student. Distribute **Know/Need to Know Log** to individual teams to be used as periodic formative assessment. Distribute **Architect Designs and Innovations Team Roles** descriptions to each student. For groups of 4 students, two of the students can share the responsibilities of Design Engineer or Research Engineer. As an assignment, each team submits a Team Contract. Examples and ideas for writing contracts can be found at http://www.google.com and searching “employment agreement contracts.” Distribute **Architect Designs and Innovations Checklist** to each team. Distribute **Architect Designs and Innovations Adapted Knowledge Rating Scale Vocabulary Development** to each student. Use as formative assessment. Students update the vocabulary development throughout the PBL experience. Students will use a word processor to begin a daily writing journal that reflects on a summary of the

lessons learned.

Discovering Formulas to Solve Oblique Triangles.
Essential Question: How can geometry and right triangle trigonometry be used to solve oblique triangles?

Students will work in pairs or teams to investigate and explore the Law of Sines. Print http://illuminations.nctm.org/Lessons/LawSinesCosines/LawSines-AS-Discover.pdf (The Law of Sines) Activity Sheet. Each team completes the activity sheet. Each team will submit a copy of their activity sheet for evaluation.

Students will work in pairs or teams to investigate and explore squares on a triangle to discover the Law of Cosines. Print http://illuminations.nctm.org/Lessons/LawCosinesGeo/LawCosinesGeo-AS-SquareTriangle.pdf (Squares on a Triangle) Activity Sheet. Each team shares a workstation and uses http://illuminations.nctm.org to complete the activity sheet. Each team will submit a copy of their activity sheet for evaluation.

2-D Silhouette Example Challenge.
Essential Question: How can a 2-dimensional model help to understand 3-dimensional space?

Distribute **2-D Silhouette Example** challenge to each team.

Investigating Formulas to Solve and Find the Area of Oblique Triangles.
Essential Question: How can solving and finding the area of oblique triangles be useful in the real world?

Students will use a word processor and work in pairs or teams to take notes from http://www.algebralab.org/studyaids/studyaid.aspx?file=Trigonometry_LawSines.xml on the Law of Sines and the area of Oblique Triangles. Each team will submit a copy of their notes for evaluation.

Students will use a word processor and work in pairs or teams to take notes from http://www.algebralab.org/studyaids/studyaid.aspx?file=Trigonometry_LawCosines.xml on the Law of Cosines and the area of Oblique Triangles. Each team will submit a copy of their notes for evaluation.

3-D Example Challenge.
Essential Question: Why is the use of a scale model important in mathematics?

Distribute **3-D Example** challenge to each team.

Presentation of **2-D Silhouette Example**. (This presentation can be used as a practice presentation. For the practice presentation, use **Practice Presentation Checklist**.)

Explore Oblique Triangles for the SAS case.
Essential Question: How can the right triangle, area formula be used to derive other area formulas?

Students will work in teams to investigate and explore oblique triangles. Students will use their notes from "Investigating Formulas to Solve and Find the Area of Oblique Triangles." Teams use http://www.sascurriculumpathways.com -> Mathematics -> Trigonometry -> Triangles: Right & Oblique -> Classroom Activity 1047 to explore oblique triangles, in particular the case in which two sides and the included angle (SAS) are given. Finding a More General Formula Activity Sheet can be used as formative assessment.

Explore Oblique Triangles for the SSA case.
Essential Question: Does every triangle have a unique solution?

Students will work in teams to investigate and explore oblique triangles. Students will use their notes from "Investigating Formulas to Solve and Find the Area of Oblique Triangles." Teams use http://www.sascurriculumpathways.com -> Mathematics -> Trigonometry -> Triangles: Right & Oblique -> Web Inquiry 116 to explore oblique triangles, in particular the case in which two sides and the non-included angle (SSA) are given. The Response Sheet can be used as formative assessment.

	Demonstrating and Applying the Derived Formulas Challenge. Essential Question: Why is the use of models important in mathematics? Distribute **Demonstrating and Applying the Derived Formulas** challenge to each team member. For help with elements of a persuasive essay, students should visit http://www.studygs.net/wrtstr4.htm. <font face="Arial Presentation of **Project Scenario**. (For the practice presentation, use **Practice Presentation Checklist**.) Invite parents and members of the community to be present during the presentation. Self/Team Evaluation. Distribute **Architect Designs & Innovations Self-Team Final Evaluation** to each team member. Each team member completes a self- evaluation and evaluates all other members of the team. Differentiation: Classroom format includes a mix of whole group, collaborative group, paired and individual activities. Quadratic functions are modeled in a wide variety of ways using physical and virtual manipulatives, graphing technology and Internet web sites. Explorations offer a variety of entry points. A Resource/Learning Center is provided that includes materials to meet the needs of all learners. Step-by-step instructions should be provided for the special needs student.
Project Evaluation:	Distribute **Architect Designs and Innovations Final Evaluation** to each team member.
Resource Files Uploaded	**Resource Files** • UP3370WS2.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS2.doc) • UP3370WS3.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS3.doc) • UP3370WS4.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS4.doc) • UP3370WS5.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS5.doc) • UP3370WS6.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS6.doc) • UP3370WS7.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS7.doc) • UP3370WS8.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS8.doc) • UP3370WS9.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS9.doc) • UP3370WS10.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS10.doc) • UP3370WS11.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS11.doc) • UP3370WS12.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS12.doc) • UP3370WS13.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS13.doc) • UP3370WS14.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3370WS14.doc)

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