Algebra II Lesson for Calculator Overflow/Underflow Using Logarithms applied to the UIL Calculator Applications Contest

Lesson Goal: To have students learn how use logarithms in working with very large numbers and numbers close to zero.

Time: 1 class period

Course: Algebra II

TEKS Addressed:
Algebra II (2) (A) Foundations for functions. The student understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations. The student is expected to use tools including factoring and properties of exponents to simplify expressions and to transform and solve equations.

Overview:
The students will learn how to solve for numbers that are too large for the calculator and how to solve for numbers that are too close to zero for the calculator to handle.

Materials Needed:

1. Scientific or Graphing Calculator (TI-83 or TI-84)
2. Example problems (attached)
3. Practice problems (attached)
4. Answer Key (attached)

Procedures:
Provide students with the Example Problems paper.

After going over both examples, give the students the worksheet over practice problems.

Have students complete the practice problems the rest of the period or assign as homework and round each answer to three significant digits.

Assessment:
Calculator overflow/underflow worksheet

Calculator Underflow Example

Find $980{,}311^{-62{,}053}$ on a calculator. If you type in 980311^(-62053) on a TI-83 or TI-84 the answer given is 0. This is because your calculator cannot handle numbers very close to zero. Using logarithms and algebra we can solve for this answer. On the state calculator test in 2011 question number 28 asks:

11I - 28   What is $980{,}311^{-62{,}053}$?

     Let x = $980{,}311^{-62{,}053}$

Take the common logarithm of both sides

     $\log x = \log(980{,}311^{-62{,}053})$

Use the exponent property of logarithms.

     $\log x = -62{,}053 \log(980{,}311)$

Type -62,053 log (980,311) into the calculator

     $\log x = -371{,}782.1026\ldots$

Subtract (-371,783) from -371,782.1026… to get a number between 0 and 1.

(-371,783) - (-371,782.1026…) = 0.89741171…

     $\log x = 0.89741171\ldots$

     $10^{\log x} = 10^{0.89741171\ldots}$

     x = 7.896083095…

Round to 3 decimal places.

Write $7.90 \times 10^{-371{,}783}$ (A number very close to zero)

Calculator Overflow Example

Find $83,946^{950,637}$ on your calculator. If you type 83946^950637 into the TI-83 or TI-84 calculator, the answer given is ERR:OVERFLOW because the number is too large for these calculators to handle. Using the properties of logarithms and algebra, we can solve for the correct answer. On the TMSCA state calculator contest in 2011 question number 28 is:

11E-28 What is $83,946^{950,637}$?

Let x = $83,946^{950,637}$

Take the common logarithm of both sides.

log x = $83,946^{950,637}$

Use the property of logarithms for exponents.

log x = 950,637log(83,946)

Type 950637log(83946) into the calculator.

log x =470916.5887...

Subtract 470916 from 470916.5887... to get 0.58866699...

log x = 0.58866699...

$10^{\log x}$ = $10^{0.58866699...}$

x = 3.878528526...

Round to 3 decimal places.

Write   3.88 x $10^{470,916}$ (A very large number)

Overflow/Underflow Practice Problems

1. 09G-37 Calculate 0.0942^{-48285}

2. 09I -37. Calculate 72057^{5912}

3. 10B-36 What is $57,893^{453,562}$?

4. 10G-36 What is $349,441^{-902,521}$?

5. What is 777^{888}?

6. What is 888^{-999}?

Overflow/Underflow Answers

1. $8.96 \times 10^{49,537}$

2. $3.82 \times 10^{28,718}$

3. $1.58 \times 10^{2,160,146}$

4. $4.80 \times 10^{-5,003,012}$

5. 4.94×10^{2566}

6. 3.43×10^{-2946}

Geometry Lesson for UIL Calculator finding areas of Geometric Figures applied to the UIL Calculator Applications Contest

Lesson Goal: To have students solve problems involving areas of regular polygons, circles, and composite figures.

Time: 1 class period

Course: Geometry

TEKS Addressed:
(8) (A) Congruence and the geometry of size. The student uses tools to determine measurements of geometric figures and extends measurement concepts to find perimeter, area, and volume in problem situations. The student is expected to find areas of regular polygons, circles, and composite figures.

Overview:
The students will learn how to solve geometric problems either by finding the area or using the area to find the length of one side.

Materials Needed:

1. Scientific or Graphing Calculator (TI-83 or TI-84)
2. Formula Sheet (attached)
3. Example problems (attached)
4. Practice problems (attached)
5. Answer Key (attached)

Procedures:
Provide students with the Example Problems paper.

After going over each example, give the students the worksheet over practice problems.

Have students complete the practice problems the rest of the period or assign as homework and round each answer to three significant digits.

Assessment:
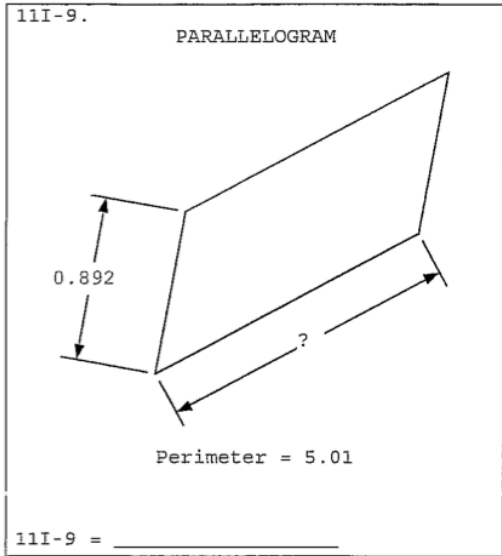Practice problems involving areas of regular polygons, circles, and composite figures

Area Formulas For Page 1 of UIL Calculator Applications

1. Regular Polygon Area = ½ aP
    where a is the apothem and P is the perimeter.

2. Circle Area = πr^2
    where π is the constant 3.14159…., and r is the radius.

3. Trapezoid Area = ½(b$_1$ + b$_2$)h
    where b$_1$ and b$_2$ are the bases and h is the height.

4. Rhombus Area = ½(d$_1$d$_2$) or Area = Base x Height
    where d$_1$ and d$_2$ are diagonals

5. Parallelogram Area = abSin(ø) or Area = Base x Height
where a and b are adjacent sides and ø is the included angle

6. Square Area = side squared

Other Formulas

1.   Circumference of Circle = $2\pi r$
            where π is the constant 3.14159…., and r is the radius.

2.   Diameter of a Circle = 2r
            where r is the radius.

3.   Perimeter of a Parallelogram = 2a +2b
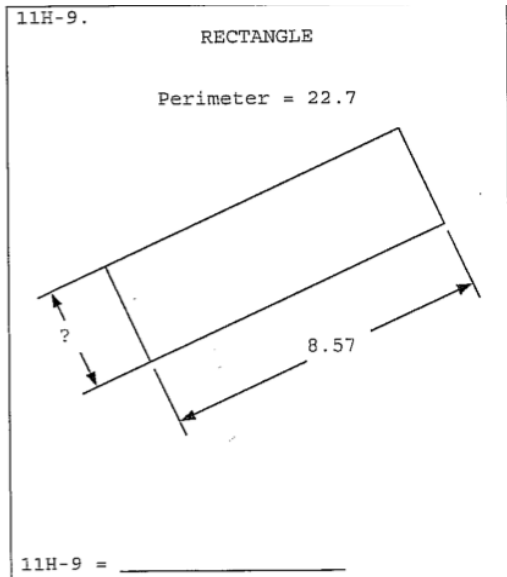   where a and b are adjacent sides

11I-9.
PARALLELOGRAM

0.892

?

Perimeter = 5.01

11I-9 = _____

11I-10.
CIRCLE

62.3

Area = ?

11I-10 = _____

11I-9   5.01 = 2(.892) + 2b
        b= 1.61

11I-10 Area = π (62.3)^2
        Area = 12200

11H-9.
RECTANGLE

Perimeter = 22.7

?

8.57

11H-9 = _____

11H-10.
RHOMBUS

Area = 53.4

7.15

?
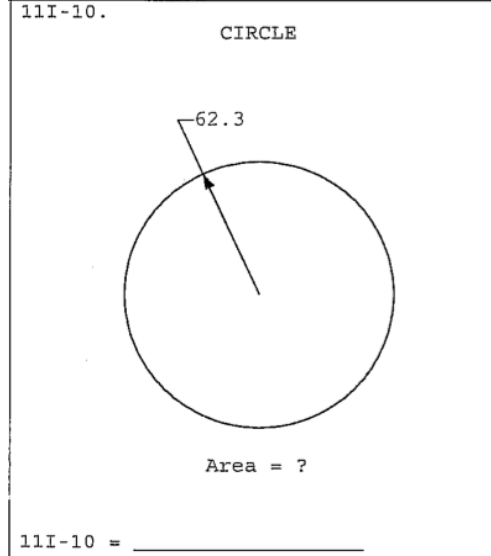
11H-10 = _____

11H-9 22.7 = 2(8.57) + 2b
        b = 2.78
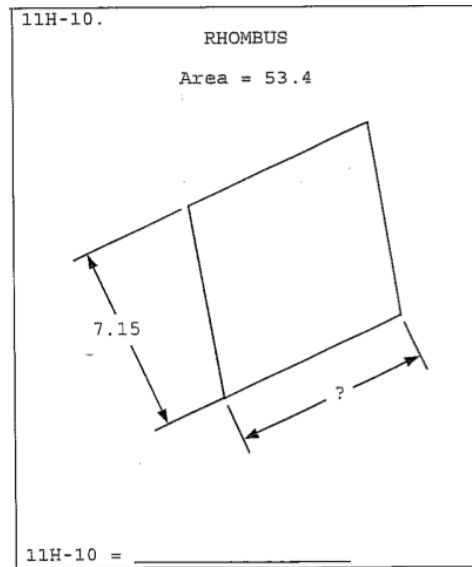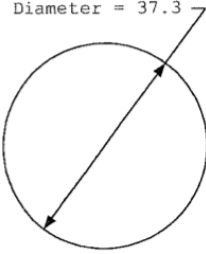
11H-10 Area = b(7.15)
        b = 7.47

Name: UIL Calculator Page 1 Practice Problems
Solve each problem. Write your answer with three significant digits.

11A-9.
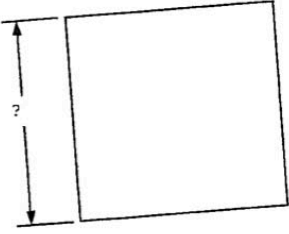
CIRCLE
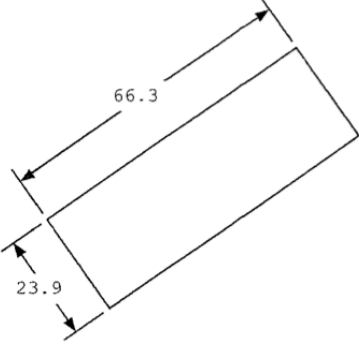
Diameter = 37.3

Circumference = ?

11A-9 = _____

11A-10.
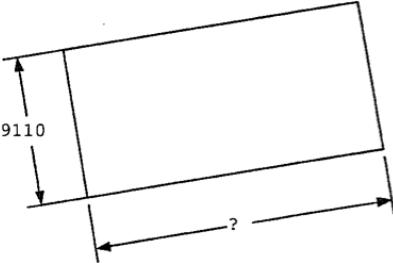
RECTANGLE

66.3

23.9

Area = ?

11A-10 = _____

11B-9.

SQUARE

?
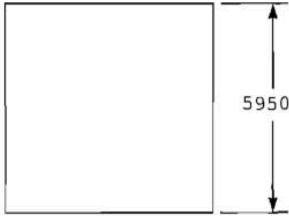
Area = 2,110

11B-9 = _____

11B-10.

RECTANGLE

9110

?

Perimeter = 54,000

11B-10 = _____

11D-9.

SQUARE

5950
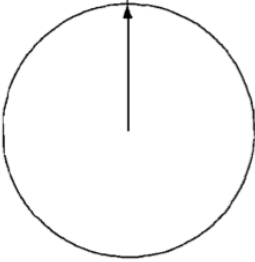
Area = ?

11D-9 = _____

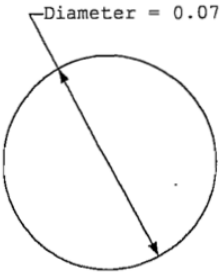**11D-10.**

CIRCLE

Circumference = 60.3

Radius = ?

11D-10 = _____

Name: UIL Calculator Page 1 Practice Problems
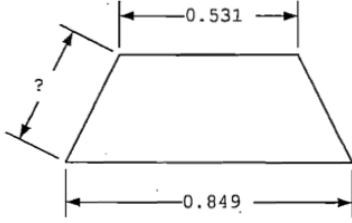
11E-9.

CIRCLE

Diameter = 0.0799

Area = ?

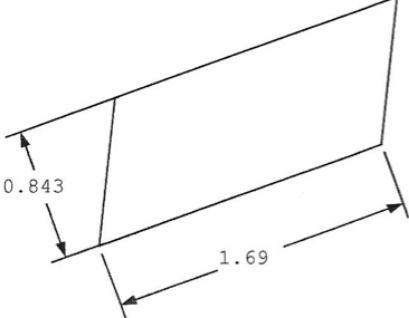11E-9 = _____

11E-10.

ISOSCELES TRAPEZOID

0.531

?

0.849

Perimeter = 2.09

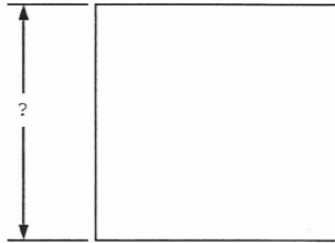11E-10 = _____

11F-9.

PARALLELOGRAM

0.843

1.69

Area = ?

11F-9 = _____

11F-10.

SQUARE

?
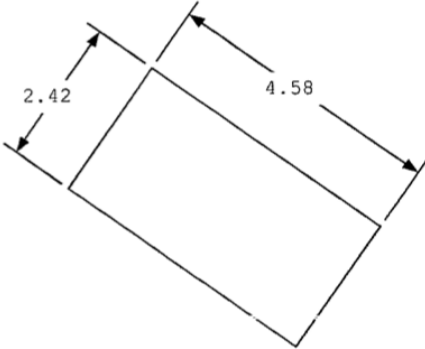
Area = 562

11F-10 = _____

11G-9.

RECTANGLE
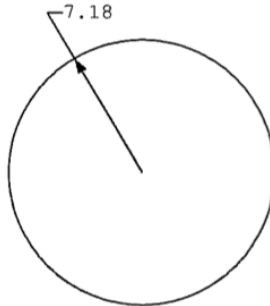
2.42

4.58

Area = ?

11G-9 = _____

11G-10.

CIRCLE

7.18

Circumference = ?

11G-10 = _____

Answer Key for Page 1 Calculator Problems

11A-9	117
11A-10	1,580
11B-9	45.9
11B-10	17,900
11D-9	2.27
11D-10	9.60
11E-9	0.00301
11E-10	0.355
11F-9	1.42
11F-10	23.7
11G-9	11.1
11G-10	45.1

Geometry Lesson for UIL Calculator Solving Right Triangles Applied to the UIL Calculator Applications Contest

Lesson Goal: To have students solve problems involving right triangles

Time: 1 class period

Course: Geometry

TEKS Addressed:
(11) (C) Similarity and the geometry of shape. The student applies the concepts of similarity to justify properties of figures and solve problems. The student is expected to develop, apply, and justify triangle similarity relationships, such as right triangle ratios, trigonometric ratios, and Pythagorean triples using a variety of methods.

Overview:
The students will learn how to solve right triangles using Pythagorean's Theorem and the three basic trigonometric functions.

Materials Needed:

1. Scientific or Graphing Calculator (TI-83 or TI-84)
2. Formula Sheet (attached)
3. Example problems (attached)
4. Practice problems (attached)
5. Answer Key (attached)

Procedures:
> Provide students with the Example Problems paper.
>
> After going over each example, give the students the worksheet over practice problems.
>
> Have students complete the practice problems the rest of the period or assign as homework and round each answer to three significant digits.

Assessment:
> Right triangles assignment

SOH

$$Sin\theta = \frac{Opposite}{Hypotenuse}$$

CAH

$$Cos\theta = \frac{Adjacent}{Hypotenuse}$$

TOA

$$Tan\theta = \frac{Opposite}{Adjacent}$$

Area of a Right Triangle
Area = ½(Base x Height)

Pythagorean's Theorem

$$Hypotenuse = \sqrt{(Leg_1)^2 + (Leg_2)^2}$$

$$Leg_1 = \sqrt{(Hypotenuse)^2 - (Leg_2)^2}$$

Unless noted with symbols or words, angles are always in radians.

11I-19.

RIGHT TRIANGLE

?

0.84 rad

Area = 0.695

11I-19 = _____

11I-20.

RIGHT TRIANGLE

?

5.12

5.65
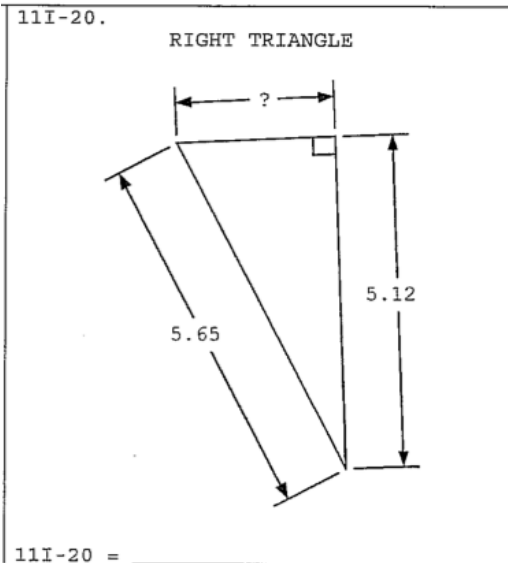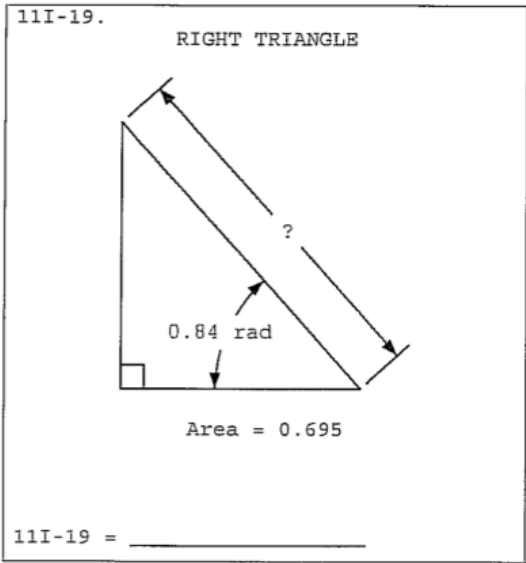
11I-20 = _____

$$\sin(0.84) = \frac{Leg_2}{?}; Leg_2 = ?\sin(0.84)$$

$$\cos(0.84) = \frac{Leg_1}{?}; Leg_1 = ?\cos(0.84)$$

11I-19 $$\frac{[?\sin(0.84)][?\cos(0.84)]}{2} = 0.695$$

$$\frac{?^2 \sin(0.84)\cos(0.84)}{2} = 0.695$$

$$? = 1.67$$

11I-20 $$? = \sqrt{(5.65)^2 - (5.12)^2}$$
$$? = 2.39$$

11H-19.

RIGHT TRIANGLE

4.29

rad?

3.61

11H-19 = _____

11H-20.

RIGHT TRIANGLE

0.0454

37.8°

?
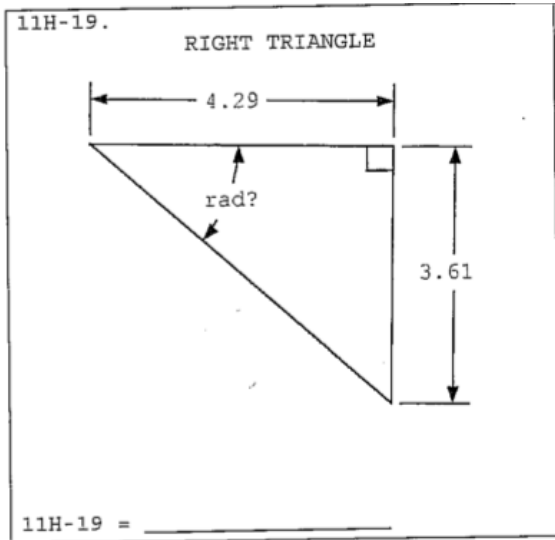
11H-20 = _____

11H-19 $$\tan\theta = \frac{3.61}{4.29}$$
$$\theta = 0.700$$
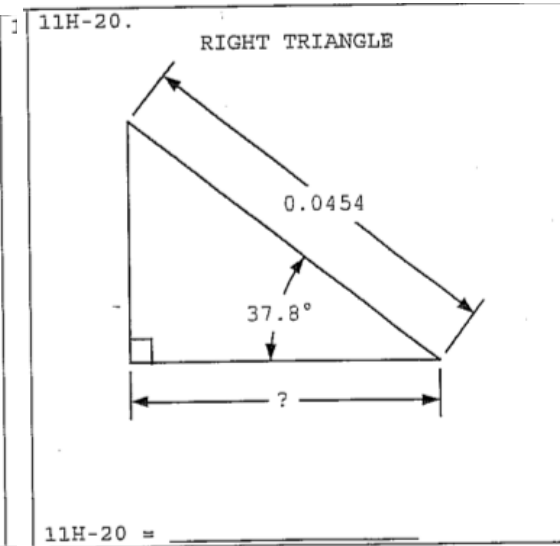
11H-20 $$\cos(37.8°) = \frac{?}{0.0454}$$
$$? = 0.0454\cos(37.8°) = 0.0359$$

Solve each problem. Write your answer with three significant digits.

11A-19.

RIGHT TRIANGLE

660

362

rad?

11A-19 = _____

11A-20.

RIGHT TRIANGLE

1.18

2.41

Area = ?

11A-20 = _____

11B-19.

RIGHT TRIANGLE

?

57.4°   0.0234

11B-19 = _____

11B-20.

RIGHT TRIANGLE

0.531

0.516

?

11B-20 = _____

11D-19.

RIGHT TRIANGLE

?

34.6°

5.25

11D-19 = _____

11D-20.

RIGHT TRIANGLE

1.33 rad   ?

Area = 995

11D-20 = _____
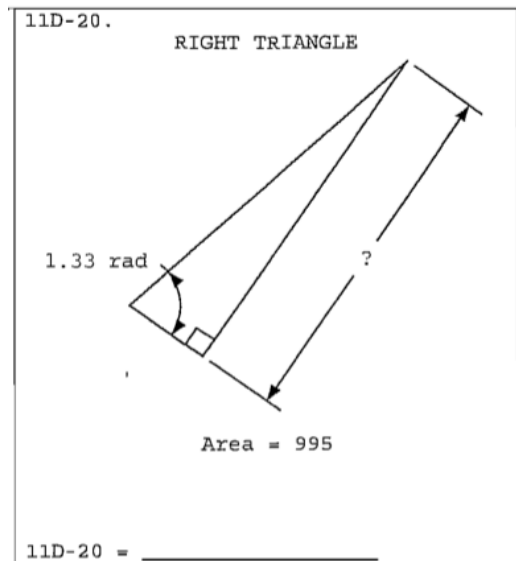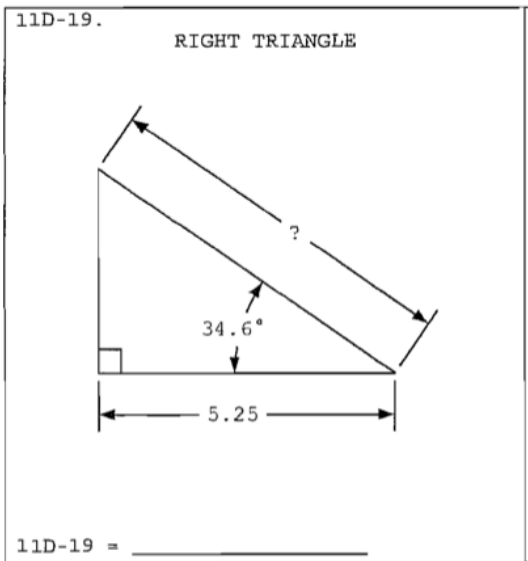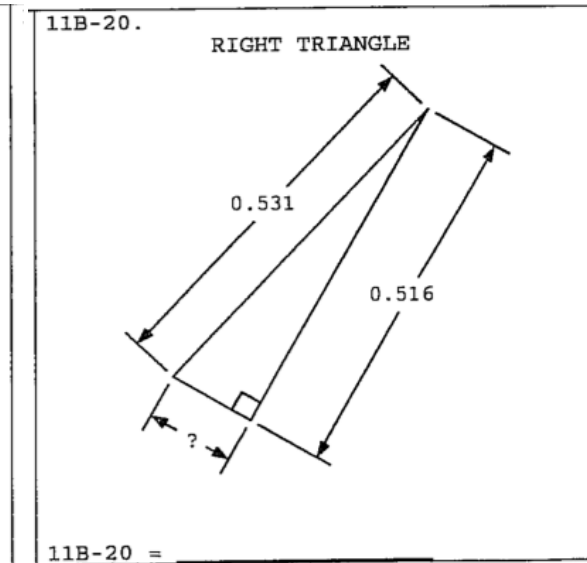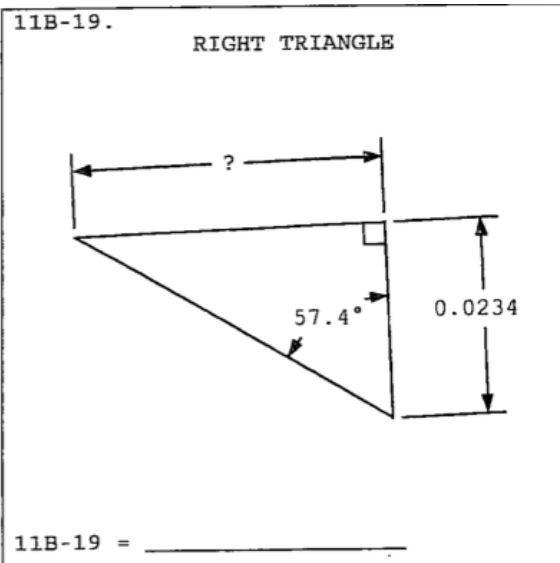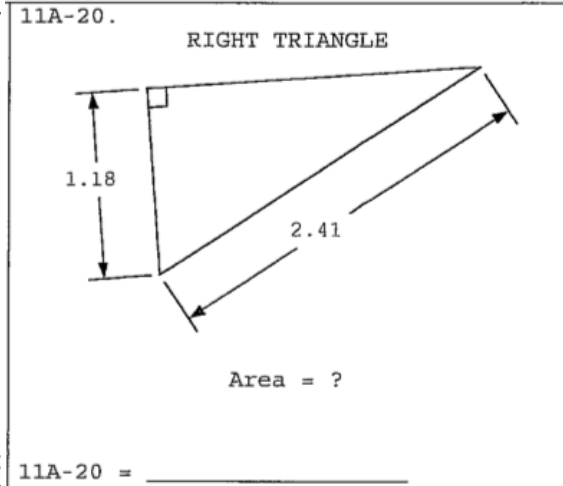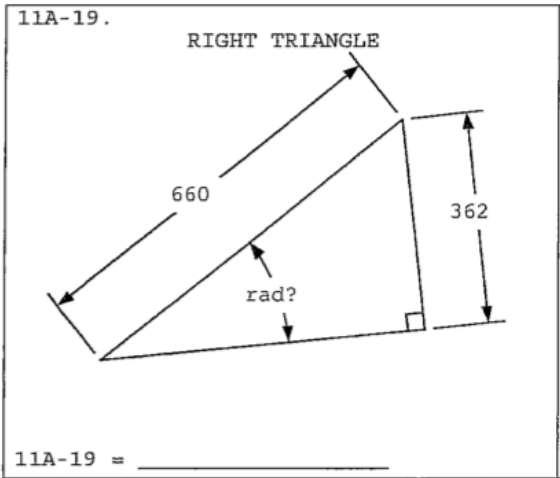
Solve each problem. Write your answer with three significant digits.

11E-19.
RIGHT TRIANGLE

0.408

1.0 rad

?

11E-19 = _____

11E-20.
RIGHT TRIANGLE

0.317

deg?

0.216

11E-20 = _____

11F-19.
RIGHT TRIANGLE

?

655

0.702 rad

11F-19 = _____

11F-20.
RIGHT TRIANGLE

1570

372

Area = ?

11F-20 = _____

11G-19.
RIGHT TRIANGLE

214

187

?

11G-19 = _____

11G-20.
RIGHT TRIANGLE

0.385

71.0°

?

11G-20 = _____

Answer Key for Page 1 Calculator Problems

11A-19	0.581
11A-20	1.24
11B-19	0.0366
11B-20	0.125
11D-19	6.38
11D-20	90.0
11E-19	0.220
11E-20	34.3
11F-19	1010
11F-20	292,000
11G-19	104
11G-20	0.364

Pre-Calculus Lesson for UIL Calculator Solving Triangles using Law of Sines and Law of Cosines applied to the UIL Calculator Applications Contest

Lesson Goal: To have students solve problems involving scalene triangles

Time: 1 class period

Course: Pre-Calculus

TEKS Addressed:

> (3)(E) The student uses functions and their properties, tools and technology, to model and solve meaningful problems. The student is expected to solve problems from physical situations using trigonometry, including the use of Law of Sines, Law of Cosines, and area formulas and incorporate radian measure where needed.

Overview:
The students will learn how to solve scalene triangles using Law of Sines and Law of Cosines.

Materials Needed:

1. Scientific or Graphing Calculator (TI-83 or TI-84)
2. Formula Sheet (attached)
3. Practice problems (attached)
4. Answer Key (attached)

Procedures:
> Provide students with the Calculator Problems paper and the formula page.
>
> After going over the first three problems allow the students to finish the other 6 problems. Help where necessary.
>
> Have students complete the practice problems the rest of the period or assign as homework and round each answer to three significant digits.

Assessment:
> Practice problems involving scalene triangles

Law of Sines   Law of Cosines

$$\frac{a}{Sin(A)} = \frac{b}{Sin(B)} = \frac{c}{Sin(C)} \qquad c^2 = a^2 + b^2 - 2abCos(C)$$

When solving for the angle in the Law of Sines, remember the ambiguous case. On the Calculator Applications test, the angle will only appear to be obtuse or acute. There may or may not be any further indication. The calculator will only give the acute angle in the Law of Sines. To get the obtuse angle, one must subtract the calculator answer from π. (180 if in degrees).

Unless noted with symbols or words, angles are always in radians.

Additional problems are available from UIL from previous year's tests.

Answer Key for Law of Sines and Law of Cosines Calculator Problems

08G-36 Two boats leave each other, one traveling northeast at 8 knots and the other traveling east at 12 knots. How long does it take them to be 100 mi apart if a knot is 1.15 mph?

Law of Cosines

$$100^2 = [8(1.15)x]^2 + [12(1.15)x]^2 - 2(8)(1.15)(12)(1.15)Cos(45°)$$

$$x = 10.2$$

11I-40.
SCALENE TRIANGLE

11I-40 = _____

11H-40.
SCALENE TRIANGLES
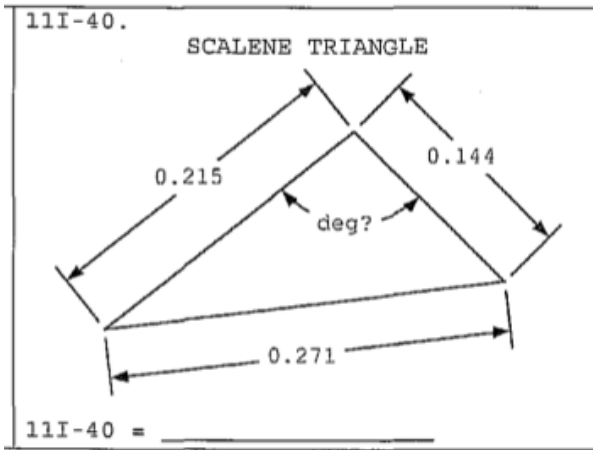
11H-40 = _____

11I-40
Law of Cosines

$$.271^2 = .215^2 + .144^2 - 2(.215)(.144)\cos\theta$$

$$\theta = 96.0°$$
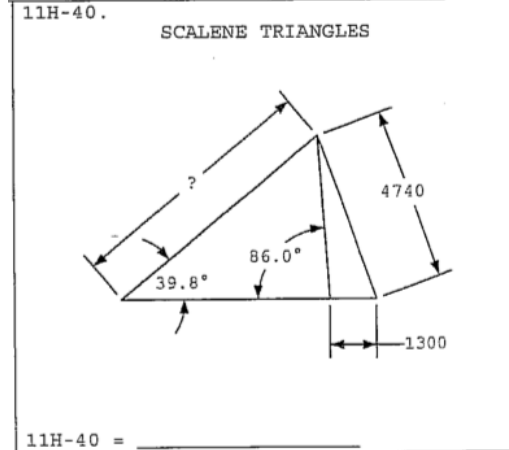
11H-40
Law of Sines   180° - 86° = 94°

$$\frac{4740}{Sin(94)} = \frac{1300}{Sin(A)}; A = 15.9°$$

$$180° - A - 94 = 70.1°$$

$$\frac{4740}{Sin(39.8)} = \frac{x}{Sin(70.1)}; x = 6960$$

11G-40.
SCALENE TRIANGLES

11G-40 = _____

11F-40.
SCALENE AND RIGHT TRIANGLES
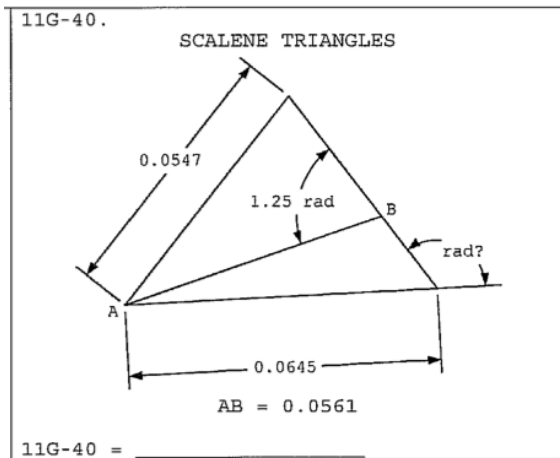
11F-40 = _____

11G-40
Law of Sines
π - 1.25 = 1.89

$$\frac{.0645}{Sin(1.89)} = \frac{.0561}{Sin(A)}; A = .971$$

$$\pi - A = 2.17$$
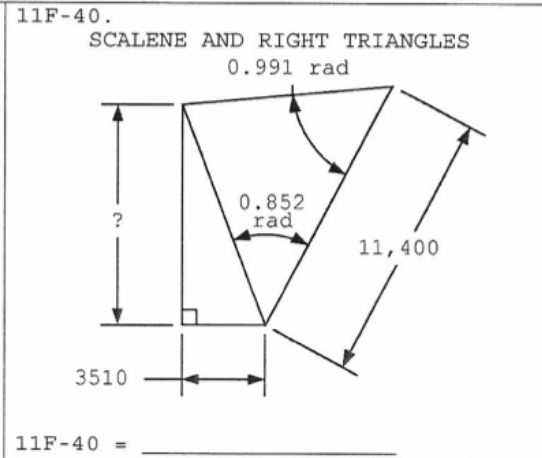
11F-40
Law of Sines
π - .852 - .991 = 1.30

$$\frac{11,400}{Sin(1.30)} = \frac{A}{Sin(.991)}; A = 9900$$

$$\sqrt{A^2 - 3510^2} = 9260$$

Answer Key for Law of Sines and Law of Cosines Calculator Problems

11E-40.
SCALENE TRIANGLE
0.628 rad
rad?
0.0448
0.0725

11E-40 =

11D-40.
SCALENE TRIANGLES
0.909
0.46
?
30.5°
1.27
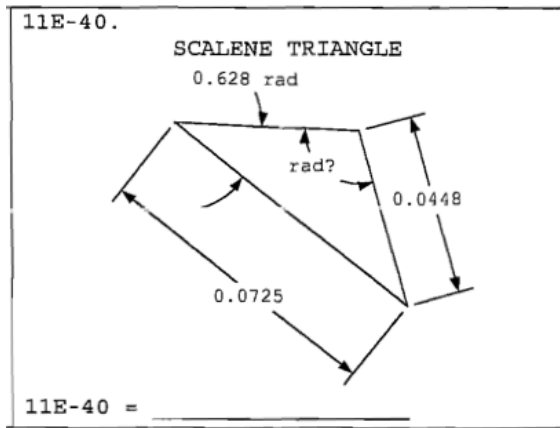
11D-40 =

11E-40 1.89
Law of Cosines

$.0725^2 = .628^2 + .0448^2 - 2(.628)(.0448)Cos(x)$

$x = 1.89$
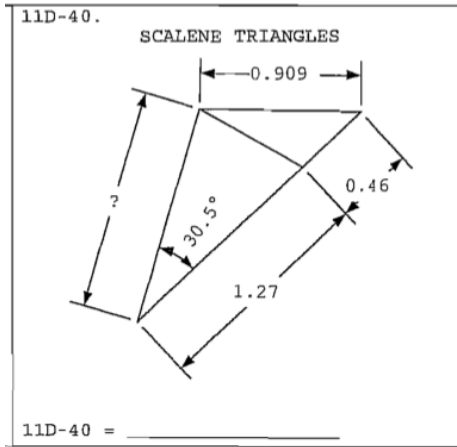
11D-40
Law of Sines

$\dfrac{.909}{Sin(30.5)} = \dfrac{1.27 + .46}{Sin(A)}; A = 75.0°$

Ambiguous

$180° - A = 105°$

$180° - 105° - 30.5° = 44.5°$

$\dfrac{.909}{Sin(30.5)} = \dfrac{x}{Sin(44.5°)}; x = 1.26$

11B-40.
SCALENE TRIANGLES
0.118
A
0.124
71.2°
0.201
B
AB = ?

11B-40 =

11A-40.
SCALENE TRIANGLE
5.61
3.82
rad?
7.76
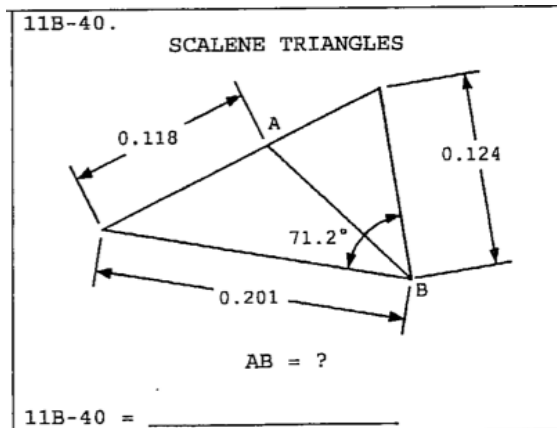
11A-40 =

11B-40
Law of Cosines

$A^2 = .201^2 + .124^2 - 2(.201)(.124)Cos(71.2°)$

$A - .118 = .0813$

$\dfrac{A}{Sin(71.2°)} = \dfrac{.201}{Sin(B°)}; B = 72.7°$

$(AB)^2 = .124^2 + .0813^2 - 2(.124)(.0813)Cos(72.7°)$

$AB = .126$
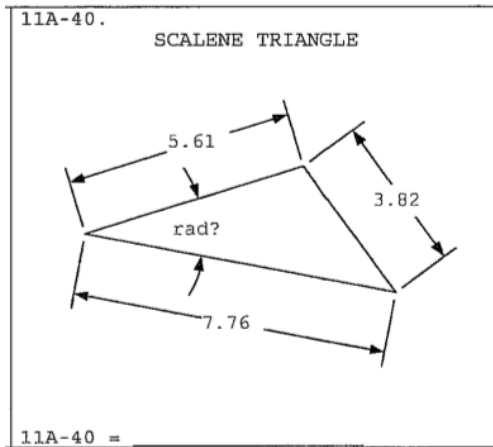
11A-40 0.483
Law of Cosines

$3.82^2 = 5.61^2 + 7.76^2 - 2(5.61)(7.76)Cos(x)$

$x = .483$

Law of Sines and Law of Cosines Calculator Problems

08G-36 Two boats leave each other, one traveling northeast at 8 knots and the other traveling east at 12 knots. How long does it take them to be 100 mi apart if a knot is 1.15 mph?

11I-40.

SCALENE TRIANGLE

0.215

0.144

deg?

0.271

11I-40 = _____

11H-40.

SCALENE TRIANGLES

?

4740

86.0°

39.8°

1300

11H-40 = _____

11G-40.

SCALENE TRIANGLES

0.0547

1.25 rad

B

rad?

A

0.0645

AB = 0.0561

11G-40 = _____

11F-40.

SCALENE AND RIGHT TRIANGLES

0.991 rad

0.852 rad

?

11,400

3510

11F-40 = _____

Law of Sines and Law of Cosines Calculator Problems

11E-40.

SCALENE TRIANGLE

0.628 rad

rad?

0.0448

0.0725

11E-40 = _____

11D-40.

SCALENE TRIANGLES

|←——0.909——→|

?

30.5°

0.46

1.27

11D-40 = _____

11B-40.

SCALENE TRIANGLES

0.118

A

0.124

71.2°

0.201

B

AB = ?

11B-40 = _____

11A-40.

SCALENE TRIANGLE

5.61

3.82

rad?

7.76

11A-40 = _____
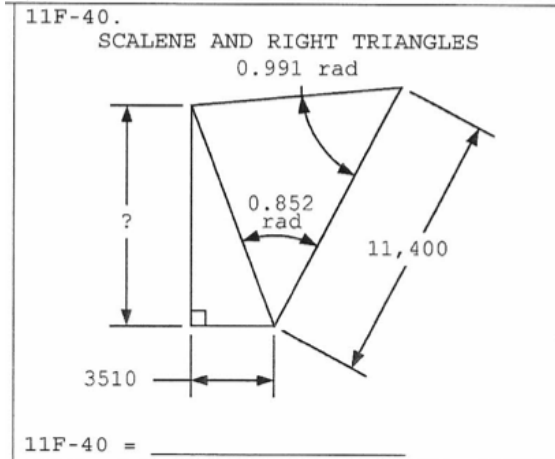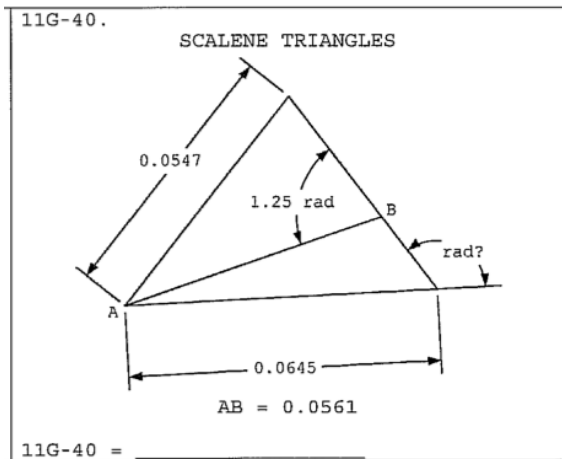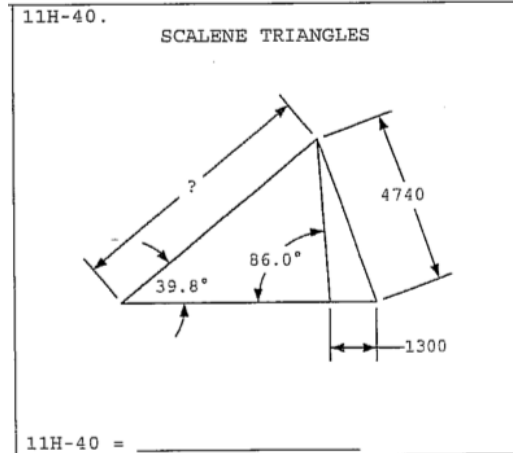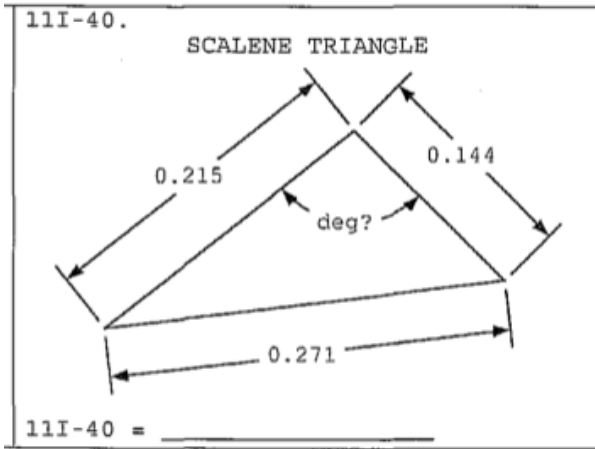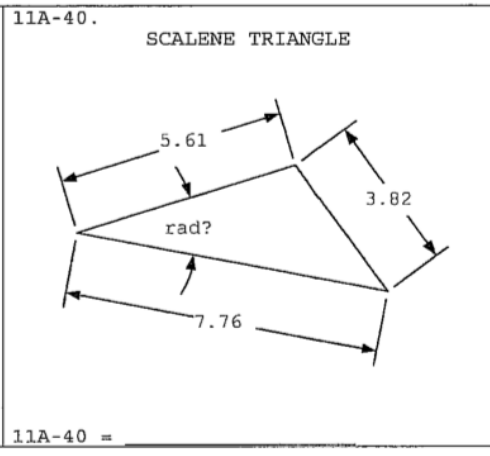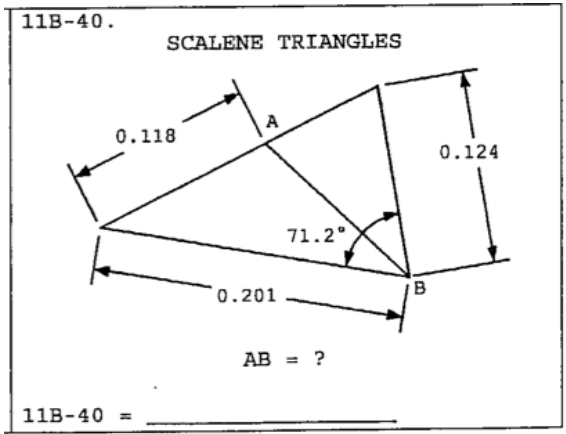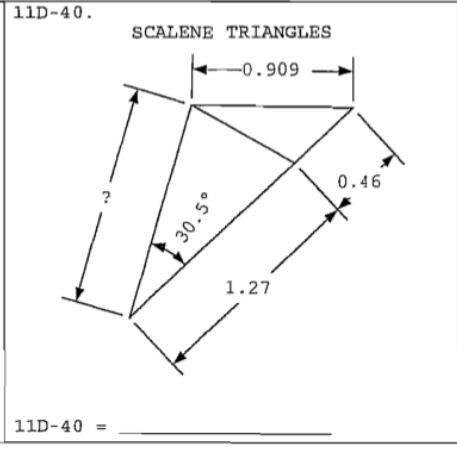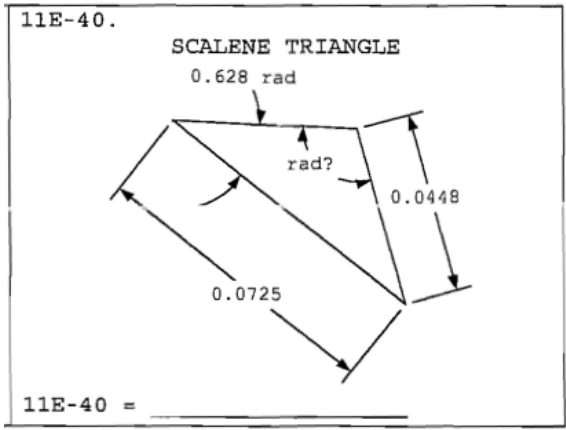
Pre-Calculus Lesson for UIL Calculator Solving Linear Regression Models applied to the UIL Calculator Applications Contest

Lesson Goal: To have students solve problems involving linear regression

Time: 2 class periods

Course: Pre-Calculus

TEKS Addressed:
(3) (A) (B) (C) The student uses functions and their properties, tools and technology, to model and solve meaningful problems. The student is expected to investigate properties of trigonometric and polynomial functions; use functions such as logarithmic, exponential, trigonometric, polynomial, etc. to model real-life data; use regression to determine the appropriateness of a linear function to model real-life data (including using technology to determine the correlation coefficient)

Overview:
The students will learn how to model different types of problem situations involving linear regression.

Materials Needed:

1. Scientific or Graphing Calculator (TI-83 or TI-84)
2. TI-83 or TI-84 Instructions (attached)
3. Practice problems with answers and help (attached)
4. Practice problems (attached)

Procedures:
Provide students with the Instruction paper.

After going over several problems, give the students the worksheet over practice problems.

Have students complete the practice problems the rest of the periods or assign as homework.

Assessment:
worksheet over linear regression

Instructions for using the TI-83 or TI-84 Calculators to find the correlation coefficient, slope, y-intercept and x or y values.

The first step is to run the DiagnosticOn program. Press the CATALOG button {(2nd)(0)} and scroll down to DiagnosticOn. These programs are listed alphabetically and pressing (ALPHA)(D) will speed things up. After selecting DiagnosticOn Press ENTER twice and the screen should show DiagnosticOn Done.

To enter data press the STAT key and then ENTER to select 1:Edit. The screen should now show L1 L2 L3 across the top.

Enter the x-values under L1 and y-values under L2.

To calculate the line of best fit press STAT CALC 4:LinReg(ax+b) and then ENTER. Variable a is the slope, b is the y-intercept, and r is the correlation coefficient. (If r is not visible see the first step above)

If an x or y value is needed make sure that Y1= is clear and then press STAT CALC 4:LinReg(ax+b) L1,L2,Y1 ENTER. (L1 is 2ND 1 and L2 is 2ND 2 and Y1 is VARS Y-VARS 1:Function 1:Y1

If a y value is needed use the TABLE to look up the answer.

 If an x value is needed, set the Y2=(given y value) and calculate the intersect between the two lines using CALC 5:intersect. The window may need adjusting.

11I-47. An unloaded spring is 3.5 in long. One-pound load stretches spring to 4.25 in. Two pounds load elongates it to 4.6 in. Three to six pounds in 1-lb increments elongates the spring to 4.85 in, 5.5 in, 6.4 in and 7.1 in. What is the spring constant, defined as the load divided by the deflection? (lb/in)

L1{0,1,2,3,4,5,6}
L2{3.5,4.25,4.6,4.85,5.5,6.4,7.1}

Find the slope of the line of best fit. (in/lb).   0.57142…
Answer the question by taking the multiplicative inverse of the slope.
1.75 lb/in

11H-47. The lifespan of dogs is inversely proportional to their weight. Calculate the life expectancy of a Dalmatian, 24 in tall, given the following information. Irish Wolfhound 35 in tall and 6 yr; Akbash 31 in and 8 yr; Bloodhound 27 in and 10 yr; Dachshund 16 in and 18 yr; and Boston Terrier l5 in and l5 yr.

Since weight is a cubic value and height is linear, cube each height and make the exponent negative since the data is inversely proportional.
L1{35^{-3},31^{-3},27^{-3},16^{-3},15^{-3}}
L2{6,8,10,18,15)
Find the line of best fit.
Plug in 24^{-3} for x and get 9.40 years

11G-47. A golfer practices driving by hitting a series of balls at 50-ft increments. His actual distances are 65 ft, 90 ft, 170 ft, 185 ft and 230 ft. What is the correlation coefficient of these data?

L1{50,100,150,200,250]
L2{65,90,170,185,230}

r = .979

Answer Key for Linear Regression Calculator Problems

11F-47. The electric current output for a square fuel cell is proportional to its area. For a 2 cm side dimension, the current was 0.3 amps. For 3 cm to 6 cm in 1-cm increments, the current was 0.6 amps, 1.5 amps, 1.8 amps, 2.5 amps. Estimate the side dimension of a fuel cell providing 5 amps current.
Since we are given a side, square the side to get area.
L1$\{2^2,3^2,4^2,5^2,6^2\}$
L2$\{.3,.6,1.5,1.8,2.5\}$
Calculate the x value given y = 5;
$x^2 = 71.192…$
x = 8.44

11E-47. The following are dates and the population in millions of the United States: (1891, 229.4), (1990, 249.6), (2000, 282.2), (2008, 304.0). Assuming linear growth, in what year will the population equal 400 million?
L1$\{1891,1990,2000,2008\}$
L2$\{229.4,249.6,282.2,304.0\}$
Use Y2= 400 and adjust window for y-max 500 and x-max 3000
x = 2239

11D-47. Terry signed up for I-tunes in January and downloaded 12 songs. The monthly number of downloads for February through June was 8, 15, 11, 13 and 14. Estimate the number of months since Terry enrolled at which the number of downloads just exceeds 200 songs.
L1$\{1,2,3,4,5,6\}$
L2$\{12,8,15,11,13,14\}$
17 months (Must round up)

11B-47. At birth Abe was 21.5 in long. On his first 5 birthdays, his height was 23 in, 28 in, 33 in, 36 in and 38 in. How tall will Abe be on his 7th birthday?
L1$\{0,1,2,3,4,5\}$
L2$\{21.5,23,28,33,36,38\}$
Use Tables.   46.2 in

11A-47. A rain gauge was emptied and then its level was measured daily without emptying it. The measurements were 0.5 in, 1.25 in, 1.68 in, 2.85 in and 4.13 in. What is the average daily rainfall [using linear regression based on this data]?
L1$\{0,1,2,3,4,5\}$
L2$\{0,.5,1.25,1.68,2.85,4.13\}$
Slope = .804 in

10I-47. Atmospheric pressure is given as "1 atm" at sea level and decreases exponentially at elevations above sea level. Selected measurements are (0 ft, 1 atm) , (18,000 ft, 1/2 atm) , (27,480ft, 1/3 atm) , (52,926ft, 0.1 atm) , (101,381 ft, 0.01 atm) and (227,899 ft, 0.0001 atm). What is the percent error in the predicted elevation where the pressure is 10^{-5} atm and the actual elevation, 283,076 ft?
L1{0, 18,000, 27,480, 52,926, 101,381, 227,899}
L2{ln(1), ln(½),ln(1/3), ln(1/10), ln(1/100), ln(1/10000)}
Let Y2 = $\ln(10^{-5})$ Find the intersection. (280,170.41)
Find the % error.
-1.0264%

10H-47. The time needed to chainsaw a branch in two varies linearly with the cross sectional area of the branch. If times associated with various branch diameters are (6 s, 1.8 in), (17 s, 3.75 in), (43 s, 4.75 in), (74 s, 7.5 in) and (106 s, 8.4 in), what diameter branch would be cut in two in 3 minutes? 11.1 in (Square the diameter)

10G-47. On October 22, 2007, there were 19,951,900 Facebook users in the United States. On Jun 18, 2008 the number grew to 26,481,100, and on January 4, 2009 it was 42,089,200. If the growth is exponential, how many days after January 4, 2009 will the number of US Facebook users reach 100 million? 542 days

10F-47. In the H1N1 Swine Flu pandemic of 2009, the number of cases reported worldwide were (4/24/2009, 0 cases), (5/4/2009, 1000 cases), (5/9/2009, 2600 cases), (5/18/2009, 8700 cases), (5/27/2009, 13200 cases), (6/6/2009, 22000 cases). If the number of cases increased with the square of time, how many days after 4/24/09 would the number of cases reach 100,000? 91.4 days

10E-47. The US Consumer Price Index (CPI) is a measure of the cost of living. The CPI in even numbered years starting in 2000 and ending in 2008 was 2.3, 2, 2, 3.6, and 3.9. Calculate the regression coefficient for the data.
.827

10D-47. Starting in 1950, the population of a bat cave was measured in five-year increments to be 32,000, 43,000, 52,000, 65,000 and 71,000. In what year did bats first occupy the bat cave? (To the nearest year) 1933

10B-47. Moore's Law predicts that the number of transistors on a circuit board doubles every 2 years. In 1971, the count was 2300. In 1981 it was 100,000; in 1990 it was 1,000,000; in 2008 it was 1.5 billion. Based on these data, what is the actual time for doubling the number of transistors? 1.94 years

10A-47. A certain type of spherical tumor grows at a constant volume rate. A patient visited the doctor at 30-day intervals; the tumor diameter was measured at 2.3 mm, 3.9 mm, 4 mm, 5.1 mm, 5.6 mm and 5.8 mm. Estimate the time from the last visit at which point the tumor diameter became 1 cm. 629 days

Name: Linear Regression Calculator Problems

11I-47. An unloaded spring is 3.5 in long. One-pound load stretches spring to 4.25 in. Two pounds load elongates it to 4.6 in. Three to six pounds in 1-lb increments elongates the spring to 4.85 in, 5.5 in, 6.4 in and 7.1 in. What is the spring constant, defined as the load divided by the deflection? (lb/in)

11H-47. The lifespan of dogs is inversely proportional to their weight. Calculate the life expectancy of a Dalmatian, 24 in tall, given the following information. Irish Wolfhound 35 in tall and 6 yr; Akbash 31 in and 8 yr; Bloodhound 27 in and 10 yr; Dachshund 16 in and 18 yr; and Boston Terrier 15 in and 15 yr.

11G-47. A golfer practices driving by hitting a series of balls at 50-ft increments. His actual distances are 65 ft, 90 ft, 170 ft, 185 ft and 230 ft. What is the correlation coefficient of these data?

11F-47. The electric current output for a square fuel cell is proportional to its area. For a 2 cm side dimension, the current was 0.3 amps. For 3 cm to 6 cm in 1-cm increments, the current was 0.6 amps, 1.5 amps, 1.8 amps, 2.5 amps. Estimate the side dimension of a fuel cell providing 5 amps current.

11E-47. The following are dates and the population in millions of the United States: (1891, 229.4), (1990, 249.6), (2000, 282.2), (2008, 304.0). Assuming linear growth, in what year will the population equal 400 million?

11D-47. Terry signed up for I-tunes in January and downloaded 12 songs. The monthly number of downloads for February through June was 8, 15, 11, 13 and 14. Estimate the number of months since Terry enrolled at which the number of downloads just exceeds 200 songs.

11B-47. At birth Abe was 21.5 in long. On his first 5 birthdays, his height was 23 in, 28 in, 33 in, 36 in and 38 in. How tall will Abe be on his 7th birthday?

11A-47. A rain gauge was emptied and then its level was measured daily without emptying it. The measurements were 0.5 in, 1.25 in, 1.68 in, 2.85 in and 4.13 in. What is the average daily rainfall [using linear regression based on this data]?

10I-47. Atmospheric pressure is given as "1 atm" at sea level and decreases exponentially at elevations above sea level. Selected measurements are (0 ft, 1 atm) , (18,000 ft, 1/2 atm) , (27,480ft, 1/3 atm) , (52,926ft, 0.1 atm) ,
(101,381 ft, 0.01 atm) and (227,899 ft, 0.0001 atm). What is the percent error in the predicted elevation where the pressure is 10^{-5} atm and the actual elevation, 283,076 ft?

10H-47. The time needed to chainsaw a branch in two varies linearly with the cross sectional area of the branch. If times associated with various branch diameters are (6 s, 1.8 in), (17 s, 3.75 in), (43 s, 4.75 in), (74 s, 7.5 in) and (106 s, 8.4 in), what diameter branch would be cut in two in 3 minutes?

10G-47. On October 22, 2007, there were 19,951,900 Facebook users in the United States. On Jun 18, 2008 the number grew to 26,481,100, and on January 4, 2009 it was 42,089,200. If the growth is exponential, how many days after January 4, 2009 will the number of US Facebook users reach 100 million?

10F-47. In the H1N1 Swine Flu pandemic of 2009, the number of cases reported worldwide were (4/24/2009, 0 cases), (5/4/2009, 1000 cases), (5/9/2009, 2600 cases), (5/18/2009, 8700 cases), (5/27/2009, 13200 cases), (6/6/2009, 22000 cases). If the number of cases increased with the square of time, how many days after 4/24/09 would the number of cases reach 100,000?

10E-47. The US Consumer Price Index (CPI) is a measure of the cost of living. The CPI in even numbered years starting in 2000 and ending in 2008 was 2.3, 2, 2, 3.6, and 3.9. Calculate the regression coefficient for the data.

10D-47. Starting in 1950, the population of a bat cave was measured in five-year increments to be 32,000, 43,000, 52,000, 65,000 and 71,000. In what year did bats first occupy the bat cave? (To the nearest year)

10B-47. Moore's Law predicts that the number of transistors on a circuit board doubles every 2 years. In 1971, the count was 2300. In 1981 it was 100,000; in 1990 it was 1,000,000; in 2008 it was 1.5 billion. Based on these data, what is the actual time for doubling the number of transistors?

10A-47. A certain type of spherical tumor grows at a constant volume rate. A patient visited the doctor at 30-day intervals; the tumor diameter was measured at 2.3 mm, 3.9 mm, 4 mm, 5.1 mm, 5.6 mm and 5.8 mm. Estimate the time from the last visit at which point the tumor diameter became 1 cm.