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|---|--|
| COURSE NAME: MPM2D – Principles of Mathematics | |
| Accumulative Activities: 01 to 17 AS Learning: Topics: (1.1 to 8.5) Teacher: Antonio Pietrangelo <div style="border: 1px solid black; padding: 5px; margin: 5px 0;">Time: Throughout Course</div> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;">Pages: 36</div> | Student's Name: Student#: <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">Due Date: Tuesday, October 26th, 2021 1:00 pm EST (Toronto Time)</div> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">Mark: /100</div> |

| Categories | Knowledge/ Understanding | Thinking/Inquiry/ Problem Solving | Communication | Application |
|------------|-----------------------------|--------------------------------------|---------------|-------------|
| Symbol | K/U | T/I | C | A |
| Weight | 25 % | 25 % | 25 % | 25 % |
| Level | | | | |

Overall Expectations:

Expectations as listed in the Ontario Curriculum course outline for your specific course.

Specific Expectations:

Unit 1 - Systems of Linear Equations

- 1.1 Representing Linear Relations
- 1.2 Solving Linear Equations
- 1.3 Graphically Solving Linear Systems
- 1.4 Solving Linear Systems: Substitution
- 1.5 Equivalent Linear Systems
- 1.6 Solving Linear Systems: Elimination
- 1.7 Exploring Linear Systems

Chapter 2: Analytic Geometry: Line Segments and Circles, and Advanced Shapes

- 2.1 Midpoint of a Line Segment
- 2.2 Length of a Line Segment
- 2.3 Equation of a Circle
- 2.4 Classifying Figures on a Coordinate Grid
- 2.5 Verifying Properties of Geometric Figures
- 2.6 Exploring Properties of Geometric Figures
- 2.7 Using Coordinates to Solve Problems

Chapter 3: Graphs of Quadratic

- 3.1 Exploring Quadratic Relations
- 3.2 Properties of Graphs of Quadratic Relations
- 3.3 Factored Form of a Quadratic Relation
- 3.4 Expanding Quadratic Expressions
- 3.5 Quadratic Models Using Factored Form
- 3.6 Exploring Quadratic and Exponential Graphs

Chapter 4: Factoring Algebraic

- 4.1 Common Factors in Polynomials
- 4.2 Exploring the Factorization of Trinomials
- 4.3 Factoring Quadratics: $x^2 + bx + c$
- 4.4 Factoring Quadratics: $x^2 + bx + c$
- 4.5 Factoring Quadratics: Special Cases
- 4.6 Reasoning about Factoring Polynomials

Chapter 5: Applying Quadratic

- 5.1 Stretching/Reflecting Quadratic Relations
- 5.2 Exploring Translations of Quadratic Relations
- 5.3 Graphing Quadratics in Vertex Form
- 5.4 Quadratic Models Using Vertex Form
- 5.5 Solving Problems Using Quadratic Relations
- 5.6 Connecting Standard and Vertex Forms

Chapter 6: Quadratic Equations

- 6.1 Solving Quadratic Equations
- 6.2 Exploring the Creation of Perfect Squares
- 6.3 Completing the Square
- 6.4 The Quadratic Formula
- 6.5 Interpreting Quadratic Equation Roots
- 6.6 Solving Problems Using Quadratic Models

Chapter 7: Similar Triangles and Trigonometry

- 7.1 Congruence and Similarity in Triangles
- 7.2 Solving Similar Triangle Problems
- 7.3 Exploring Similar Right Triangles
- 7.4 The Primary Trigonometric Ratios
- 7.5 Solving Right Triangles
- 7.6 Solving Right Triangle Problems

Chapter 8: Acute Triangle Trigonometry

- 8.1 Exploring the Sine Law
- 8.2 Applying the Sine Law
- 8.3 Exploring the Cosine Law
- 8.4 Applying the Cosine Law
- 8.5 Solving Acute Triangle Problems

Rubrics:

| Category | Level R (0 – 49%) | Level 1 (50-59%) | Level 2 (60-69%) | Level 3 (70-79%) | Level 4 (80-100%) | Level/ Mark |
|--|--|--|---------------------------------------|---|---|----------------|
| Knowledge – Understanding of (Specific Expectations: 1.1 to 8.5) | demonstrates insufficient understanding | demonstrates limited understanding | demonstrates some understanding | demonstrates considerable understanding | demonstrates thorough understanding | |
| | | | | | | |
| | | | | <div>Individual: Mark:</div> | | |

| Category | Level R (0 – 49%) | Level 1 (50-59%) | Level 2 (60-69%) | Level 3 (70-79%) | Level 4 (80-100%) | Level/ Mark |
|--|--|---|--|--|---|----------------|
| Thinking and Inquiry (What if scenarios) of: (Specific Expectations: 1.1 to 8.5) | demonstrates insufficient ability to apply different scenarios | demonstrates limited ability to apply different scenarios | demonstrates some ability to apply different scenarios | demonstrates considerable ability to apply different scenarios | demonstrates through ability to apply different scenarios | |
| | | | | | | |
| | | | | Individual: Mark: | | |

| Category | Level R (0 – 49%) | Level 1 (50-59%) | Level 2 (60-69%) | Level 3 (70-79%) | Level 4 (80-100%) | Level/ Mark |
|--|---|--|---|---|--|----------------|
| Communication Communicates effectively (Specific Expectations: 1.1 to 8.5) | demonstrates insufficient ability to communicate effectively | demonstrates limited ability to communicate effectively | demonstrates some ability to communicate effectively | demonstrates considerable ability to communicate effectively | demonstrates through ability to communicate effectively | |
| | | | | | | |
| | | | | <div>Individual: Mark:</div> | | |

| Category | Level R (0 – 49%) | Level 1 (50-59%) | Level 2 (60-69%) | Level 3 (70-79%) | Level 4 (80-100%) | Level/ Mark |
|--|---|--|-------------------------------------|---|---|----------------|
| <u>Application:</u> Demonstrates the ability to apply mathematical principles to real world situations. (Specific Expectations) (A1.1 to A2.3) | demonstrates insufficient ability | demonstrates limited ability | demonstrates some ability | demonstrates considerable ability | demonstrates thorough ability | |
| | | | | | | |
| | | | | <div>Individual: Mark:</div> | | |

PART A: KNOWLEDGE AND UNDERSTANDING (K/U) – 25%

PART B: THINKING AND INQUIRY (T/I) - 25%

PART C: COMMUNICATION (C) – 25%

PART D: APPLICATION (A) – 25%

Each activity will be out of 10 marks, and can be an assessment of one or more of PART A through D.

Activity 01: - Exploring basic parabola: Parent Parabola: $y = x^2$

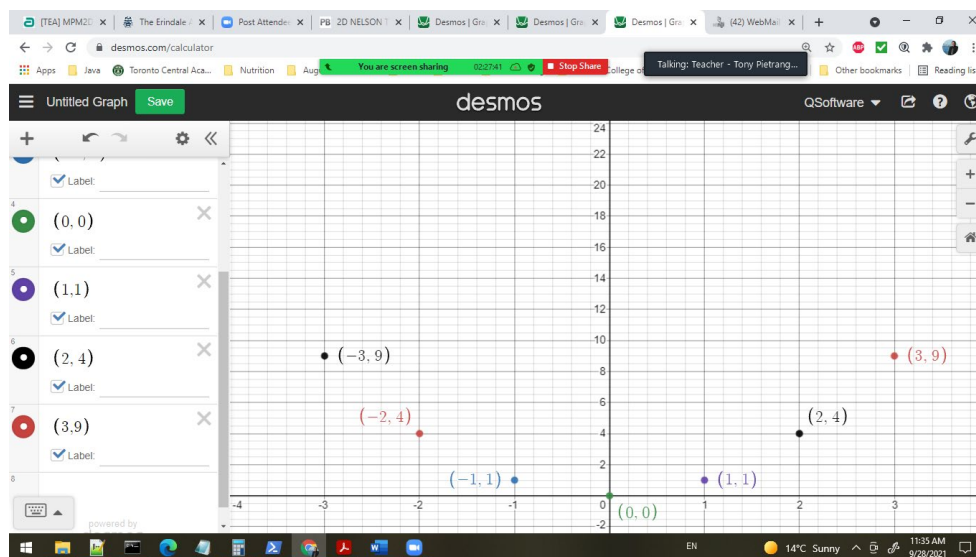
Activity:

Make a table of values from a domain of x integer values from -3 to +3 and then graph the points on a graph. Join the points trying to make a smooth curve as best as possible.

a) $y = x^2$

| X value | $y = x^2$ | Y Value | Point(x,y) |
|---------|--------------|---------|------------|
| -3 | $Y = (-3)^2$ | 9 | $(-3, 9)$ |
| -2 | $Y = (-2)^2$ | 4 | $(-2, 4)$ |
| -1 | $Y = (-1)^2$ | 1 | $(-1, 1)$ |
| 0 | $Y = (0)^2$ | 0 | $(0, 0)$ |
| 1 | $Y = (1)^2$ | 1 | $(1, 1)$ |
| 2 | $Y = (2)^2$ | 4 | $(2, 4)$ |
| 3 | $Y = (3)^2$ | 9 | $(3, 9)$ |

Plot on a graph:



Activity 02 – Exploring parabolas:

1. Make a table of values for the following equations:
2. Plot the points on the Desmos graphing software.

a) $y = x^2$ ← done by instructor.

b) $y = 2x^2$

c) $y = -x^2$

d) $y = -\frac{1}{2}x^2$

e) $y = x^2 + 2x + 3$

Your work:

1. Show me a table of points from x integer values ($-5 \leq x \leq 5$) and get the values for y.
2. Plot these points on a graph by themselves first.
3. Plot the equation on the points above.
4. Take a screen snapshot and place into your document for that equation.
5. After all the individual points, and equations are plotted individually, place all the equations together on the same graph.

Activity 02: - (Quadric Equations)

1. Create a table of points for the following equations (x values from -9 to 9)

- a) $y = -3x^2$
- b) $y = \frac{1}{4}x^2$
- c) $y = -(\frac{1}{4})x^2$

Graph the following equations

1. Create a table of points for the following equations (x values from -9 to 9)

- a. $Y = x^2$
- b. $Y = (x - 9)^2$
- c. $Y = (x + 2)^2$
- d. $Y = (x - 5)^2$

2. Create a table of points for the following equations (x values from -9 to 9)

- a. $Y = x^2 + 8$
- b. $Y = x^2 - 5$
- c. $Y = x^2 - 10$



Activity 3: Set up Demos Graphing Software to handle all the 3 variables, a, h, k in formula:

Explain in English what are the effects of a, h, k to the formula. Take screen snap shots through our explanation to prove the effects the changing variables.

$$y = a(x - h)^2 + k$$

If $k > 0$, the original graph is vertical shift upwards.

If $k < 0$, the original graph has vertical shift, but downwards.

if $h > 0$, the original graph has a horizontal shift to the right.

If $h < 0$, the original graph has a horizontal shift to the left.

Please explain the effects of a under the conditions below:

Type 1: when $a \geq 1$

Type 2: when $0 < a < 1$

Type 3: when $a \leq -1$

Type f: when $-1 < a < 0$;

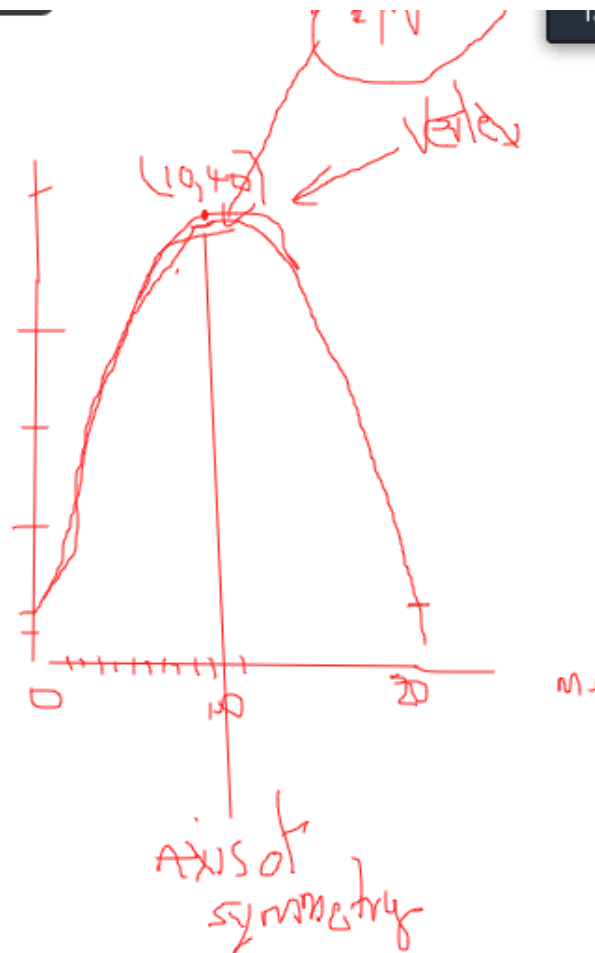
Activity 04: Parabolas – axis of symmetry

1. Describe the properties of the parabola with the equation of: $y = 2(x - 4)^2 - 3$.
2. Word Problem:

At a fireworks display, a firework was launched from a height of 2 meters above the ground and reaches a maximum height of 40 meters at a horizontal distance of 10 meters.

 - a) Determine an equation to model the flight path of the firework.
 - b) The firework continues to travel an additional 1-meter horizontality, after it reaches its maximum height, before it explodes. What is its height when it explodes?
 - c) At what other horizontal distance is the firework at the same height as in part b).

See sketch below for a rough drawing:



Activity 05:- Analyze the form of parabola:

$$y = a(x - r)(x - s)$$

Examples:

$$y = 2(x - 5)(x + 3) \text{ where } x \text{ is a set of integers: } -6 \text{ to } +6.$$

| X value | Y value $y=2(x-5)(x+3)$ | Point (x, y) |
|---------|--|----------------|
| -6 | $y=2(-6-5)(-6+3)$ $y=2(-11)(-3) = 66$ | $P_1 (-6, 66)$ |
| -5 | $y=2(-5-5)(-5+3)$ $y=2(-10)(-2) = 40$ | $P_2 (-5, 40)$ |
| -4 | $y=2(-4-5)(-4+3)$ | |
| -3 | | |
| -2 | | |
| -1 | | |
| 0 | | |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |

Create a table of points for the parabola below.

$$y = -\left(\frac{1}{2}\right)(x + 2)(x - 6)$$

1. Create a table of points for both parabolas
2. Plot all the points on a graph using Demos Graphing Software.
3. Add the equation of the line symmetry
4. State the vertex of each equation.

Activity 06: Sketch all 3 relations on the same graph.

Question 1: Sketch all 3 relations on the same graphs.

a) $y = (x + 3)(x - 1)$

b) $y = 2(x + 3)(x - 1)$

c) $y = -2(x + 3)(x - 1)$

Question 2: Sketch all three relations on the same set of axes.

Find the x-intercepts, axis of symmetry, for the following:

a) $y = (x - 4)(x - 8)$

b) $y = \frac{1}{2}(x - 4)(x - 8)$

c) $y = \frac{1}{4}(x - 4)(x - 8)$

Question 3: Sketch all four relations on the same set of axes and find the x-intercepts, axis of symmetry, for the following:

a) $y = (x - 6)(x - 2)$

b) $y = -(x + 3)(x + 7)$

c) $y = 2(x - 3)(x + 2)$

d) $y = 2(x - 4)(x + 2)$

Activity 07: Evaluate expressions with powers below:

| | |
|--|---|
| <p>Question 1: Review each power with a positive exponent.</p> <p>a) 3^{-2} b) 5^{-1} c) 10^{-4} d) 7^{-3} e) $(-2)^{-4}$ f) $(-7)^{-1}$</p> | <p>Question 2: Evaluate</p> <p>a) 6^{-2} b) 9^0 c) 7^{-1} d) 10^{-3} e) $(-9)^{-1}$ f) $(-12)^{-2}$ g) $(-3)^0$ h) 89^0</p> |
| | |
| <p>Question 3: Evaluate</p> <p>1. $(\frac{1}{3})^{-2}$ 2. 0^{-5} 3. $-(\frac{1}{4})^{-1}$ 4. $(\frac{5}{6})^{-2}$ 5. $(-\frac{3}{8})^{-4}$ 6. $((\frac{9}{4})^3)^{-4}$</p> | <p>Question 4: Evaluate</p> <p>a) $6^0 + 6^{-2}$ b) $8 - 8^{-1}$ c) $(4 + 3)^0$ d) $4^0 + 3^0$</p> |

Activity 08: Classification of Polynomials.

Question 1: Classify each polynomial in terms and degrees.

| Polynomial | Number of Terms | Degree of Polynomial |
|--------------------------------|-----------------|----------------------|
| $-3y$ | 1 | first-degree |
| $5 + 6a^3$ | 2 | third-degree |
| $6x^2 + x - 1$ | 3 | second-degree |
| $8a^4b^4 - 6a^3b^2 + 2ab^2$ | 3 | eight-degree |
| $5d^3e - 7e$ | 2 | fourth-degree |
| $9 + 5y^5 - 4y^2 + y$ | 4 | fifth-degree |
| $8a^3b^2 + 9a^2b - 6a^4b^2$ | 3 | Sixth-degree |
| $10x^7y^2 - 3x^3y^3 + 5x^4y^4$ | 3 | ninth-degree |
| $6abc - 5a^2bc^2 - 7abc^2$ | 3 | fifth-degree |

Question 2: Add and Subtract Polynomials:

To add, remove the brackets and then collect like terms.

To subtract, add the opposite polynomial.

| Polynomial | Answer |
|--|------------------------|
| $(2x^2 + 3x - 5) + (7x^2 + 6x - 2)$ $= 2x^2 + 3x - 5 + 7x^2 + 6x - 2$ $= 2x^2 + 7x^2 + 3x + 6x - 2$ $= 9x^2 + 9x - 7.$ | $9x^2 + 9x - 7.$ |
| $(4a^2 + 5ab - 9b^2) - (7a^2 - 6ab + 2b^2)$ $= 4a^2 + 5ab - 9b^2 - 7a^2 + 6ab - 2b^2$ $= 4a^2 - 7a^2 + 5ab + 6ab - 2b^2$ $= -3a^2 + 11ab - 11b^2$ | $-3a^2 + 11ab - 11b^2$ |
| Simply the following: | |
| $(5x + 7) + (2x - 11)$ $= 5x + 2x + 7 - 11$ $= 7x - 4$ | $7x - 4$ |
| $(3b - 8) - (6b - 7)$ $=$ | |
| $(5x^2 + 6x + 8) + (2x^2 + 5x - 9)$ | |
| $(9y^3 - 7y^2 + 6) - (3y^3 - 5y^2 + 8)$ | |
| $(7a^2 + 3a - 4) + (8a^2 - 2a - 15)$ | |
| $(2c^2 - 3c + 1) - (-c^2 - 3c - 5)$ | |
| $(7x^2 + 3xy - 2y^2) + (8x^2 - xy - y^2)$ | |
| $(4g^2 + gh - 7h^2) - (g^2 - 2gh + 3h^2)$ | |
| $(5ab^2 + 7a - b) + (3ab^2 - 5a + 6b)$ | |
| $(3cd^2 + 2c + 9d) - (2cd^2 + 2c - d)$ | |
| $(2x + 8) - (6x - 7) + (5x - 1)$ | |
| $(5a^2 - b) + (6b - 2a^2) - (b^2 + 7a^2)$ | |

Review: Product of a Monomial and Polynomial using Distributive Property:

| <u>Distributive Property</u> |
|--|
| $2(x + 3)$ $= 2(x) + 2(3)$ $= 2x + 6$ |
| $-a(3a + 5)$ $= -a(3a) + (-a)(5)$ $= -3a^2 - 5a$ |
| $2x(x + 1)$ $= 2x(x) + 2x(1)$ $= 2x^2 + 2x$ |
| $3(x + 2)$ $= 3(x) + 3(2)$ $= 6x + 6$ |
| $4(x + 2)$ $= 4(x) + 2(4)$ $= 4x + 8$ |
| $x(x + 3)$ $= x(x) + 3x$ $= x^2 + 3x$ |
| $4x(x + 4)$ $= 4x(x) + 4(4)$ $= 4x^2 + 16$ |

| Multiply these polynomials | Answer |
|--|----------------|
| $(x + 1)(x + 2)$ | $x^2 + 3x + 2$ |
| $(x + 2)(x + 4)$ | |
| $(x + 3)(2x + 1)$ | |
| $(2x + 3)(x + 1)$ | |
| | |
| $(x + 3)(x + 8)$ | |
| $(2x + 5)(x + 4)$ | |
| $(4x + 7)(3x + 1)$ | |
| | |
| $(x + 2)(x + 5)$ | |
| $(x - 2)(x + 4)$ | |
| $(3x + 7)(x - 5)$ | |
| | |
| Expand and simply | |
| $-2(4x - 5)(7x - 6)$ | |
| $2(x + 7)(x - 3) - (4x + 3)(2x - 1)$ | |
| | |
| Use distributive Property to find the binomial product | |
| $(k - 3)(k - 5)$ | |
| $(y - 3)(y - 4)$ | |
| $(x - 2)(x - 4)$ | |
| $(q - 4)(q - 2)$ | |
| $(j - 7)(j - 1)$ | |
| $(p - 9)(p - 3)$ | |
| $(z - 7x)(z - 8x)$ | |
| $(b - 3c)(b - 11c)$ | |

Factoring: Determine the Greatest Common Factor (GCF)

| | | |
|--|-------------------|--------------------|
| 12 | 1, 12, 6, 2, 3, 4 | 1, 2, 3, 4, 6, 12, |
| 18 | 1, 18, 2, 9, 3, 6 | 1, 2, 3, 6, 18 |
| | | |
| Greatest Common Factor is: 6 for (12, 18) | | |
| 10 | | |
| 24 | | |
| Greatest Common Factor is: | | |
| 16 | | |
| 32 | | |
| Greatest Common Factor is: | | |
| 8 | | |
| 14 | | |
| Greatest Common Factor is: | | |
| 28 | | |
| 40 | | |
| Greatest Common Factor is: | | |
| Find the Greatest Common Factors for: | | |
| 6 and 9 | | |
| 25 and 15 | | |
| 24 and 16 | | |
| 20 and 28 | | |
| 36 and 15 | | |
| 32 and 40 | | |

Activity 09: Expand and Simplify

| | Expanded | Simplified |
|---------------|----------|------------|
| $(x + 3)^2$ | | |
| $(x + 2)^2$ | | |
| $(x - 6)^2$ | | |
| $(x - 4)^2$ | | |
| $(2x + 5)^2$ | | |
| $(3x - 1)^2$ | | |
| $(2x - 5y)^2$ | | |
| $(4x - y)^2$ | | |
| $(a + b)^2$ | | |
| $(a - b)^2$ | | |
| $(3a + 2)^2$ | | |
| $(5m - 3)^2$ | | |
| $(4 + 2b)^2$ | | |
| $(7 - 3z)^2$ | | |
| $(2x + 3y)^2$ | | |

Topic 2: Product of a Sum and a Difference of Two Terms:

Example: Expand and Simply

| | Expanded | Simplified |
|--|-----------------------------------|-------------------------------|
| $(x + 3)(x - 3)$ | $x^2 - 3x + 3x - 9$ | $x^2 - 9$ |
| $(2y + 5)(2y - 5)$ | $4y^2 - 10y + 10y - 25$ | $4y^2 - 25$ |
| $(x - 4)(x + 4)$ | $x^2 + 4x - 4x - 16$ | $x^2 - 16$ |
| $(3k - 7)(3k + 7)$ | $9k^2 + 21k - 21k - 49$ | $9k^2 - 49$ |
| <p>In general: $(a + b)(a - b)$ $= a^2 - ab + ba - b^2$ $= a^2 - b^2$</p> <p>This is referred to difference of squares. $a^2 - b^2 = (a + b)(a - b)$</p> | | |
| Factor These terms below: | | |
| Difference of Squares | Factor the squares | Proof Expand the terms. |
| $x^2 - 4$ | $x^2 - 2^2 = (x + 2)(x - 2)$ | $x^2 + 2x - 2x - 4 = x^2 - 4$ |
| $x^2 - 9$ | | |
| $4x^2 - 1$ | $(2x)^2 - 1^2 = (2x + 1)(2x - 1)$ | |
| $9x^2 - 16$ | | |
| $4x^2 - 9y^2$ | | |
| $9m^2 - 4n^2$ | | |
| | | |
| | | |
| | | |

Topic 3: Perfect Square trinomials (3 terms)

Example: Expand and Simply

| | Expanded | Simplified |
|---|---|--|
| $(x + 3)^2$ | $(x + 3)(x + 3)$ $= x^2 + 3x + 3x + 9$ $= x^2 + 6x + 9$ | |
| $(x + 2)^2$ | $(x + 2)(x + 2)$ $= x^2 + 2x + 2x + 4$ $= x^2 + 4x + 4$ | |
| $(x + 4)^2$ | | |
| Generic Form $(a + b)^2$ | $(a + b)(a + b)$ $= a^2 + ab + ba + b^2$ $= a^2 + 2ab + b^2$ | $= a^2 + (2)ab + b^2$ $= a^2 + 2ab + b^2$ |
| $(x - 6)^2$ | $(x - 6)(x - 6)$ $= x^2 - 6x - 6x + 36$ $= x^2 - (2)(6x) + 36$ $= x^2 - 12x + 36$ | |
| $(2x - 4)^2$ | $(2x - 4)(2x - 4)$ $= 4x^2 - 8x - 8x + 16$ $= 4x^2 - 16x + 16$ Quickly: $= (2x)^2 - (2)(2x)(4) + (-4)(-4)$ $= 4x^2 - 16x + 16$ | |
| Generic Form $(a - b)^2$ | $(a - b)(a - b)$ $= a^2 - ab - ba + b^2$ $= a^2 - 2ab + b^2$ | $= a^2 - (2)ab + b^2$ $= a^2 - 2ab + b^2$ |
| | | |
| In general: Perfect Squares (Trinomials) $(a + b)^2$ $= a^2 + 2ab + b^2$ $(a - b)^2$ $= a^2 - 2ab + b^2$ | | |

Topic 4: Factoring Quadratic Expression in form of $x^2 + bx + c$, $a = 1$

Quadratic questions: (3 forms)

1. $y = a(x - h)^2 + k$
2. $y = a(x - r)(x - s)$
3. $y = ax^2 + bx + c$ ← studying now, where $a = 1$

| | Expanded | Equate | | | | | | | | | | | | |
|---|---|---|--------------------------|---------------------------------|--------------------|-------|----|----|------|----|---|-------------|----|---|
| General Form: $y = ax^2 + bx + c$, $a = 1$ $y = x^2 + bx + c$ | | | | | | | | | | | | | | |
| $y = a(x + r)(x + s)$, $a = 1$ $y = (x + r)(x + s)$ | $= x^2 + rx + sx + rs$ $= x^2 + (r + s)x + rs$ | $x^2 + bx + c = x^2 + (r + s)x + rs$ $b = (r + s)$ $c = (r \times s)$ | | | | | | | | | | | | |
| <p>In general: Transition for the form 2 to 3 above. $x^2 + bx + c = x^2 + (r + s)x + rs$</p> <p>$b = (r + s)$ $c = (r \times s)$</p> <p>Examples of factor r, s, where r, s are only integers.</p> | | | | | | | | | | | | | | |
| <u>Factor, if possible</u> $x^2 + 7x + 12$ | $b = 7$, $c = 12$ $(x + r)(x + s)$ $= (x + 3)(x + 4)$ $= x^2 + 4x + 3x + 12$ $= x^2 + 7x + 12$ | <table border="1"> <thead> <tr> <th>Factors (r, s)</th><th>Product c $c = r \times s$</th><th>Sum $b = r + s$</th></tr> </thead> <tbody> <tr> <td>1, 12</td><td>12</td><td>13</td></tr> <tr> <td>2, 6</td><td>12</td><td>8</td></tr> <tr> <td>3, 4</td><td>12</td><td>7</td></tr> </tbody> </table> | Factors (r , s) | Product c $c = r \times s$ | Sum $b = r + s$ | 1, 12 | 12 | 13 | 2, 6 | 12 | 8 | 3, 4 | 12 | 7 |
| Factors (r , s) | Product c $c = r \times s$ | Sum $b = r + s$ | | | | | | | | | | | | |
| 1, 12 | 12 | 13 | | | | | | | | | | | | |
| 2, 6 | 12 | 8 | | | | | | | | | | | | |
| 3, 4 | 12 | 7 | | | | | | | | | | | | |
| $x^2 + 4x + 6$ | | | | | | | | | | | | | | |
| $x^2 - 29x + 28$ | | | | | | | | | | | | | | |
| $x^2 + 3x - 28$ | | | | | | | | | | | | | | |

| | | | | |
|-----------------|--|-------------------|---------------------------------|------------------------|
| $x^2 - 4x - 21$ | $b = -4, c = -21$ $r, s = (3, -7)$ $b = (r + s)$ $= (x + 3)(x - 7)$ $= (x - 7)(x + 3)$ Proof: $= x^2 - 7x + 3x - 21$ $= x^2 - 4x - 21$ | Factors (r, s) | Product (c) $c = r \times s$ | Sum (b) $b = r + s$ |
| | | -1, 21 | -21 | 20 |
| | | -3, 7 | -21 | 4 |
| | | 1, -21 | -21 | 20 |
| | | 3, -7 | -21 | -4 |

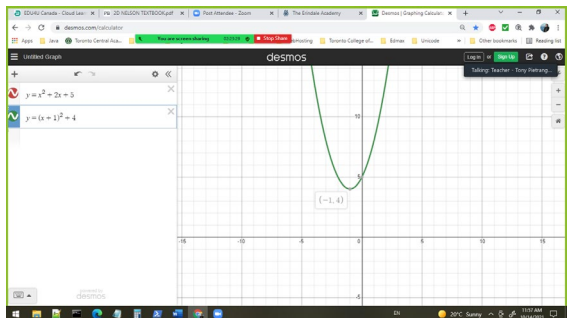
Activity 10: Factor these parabolic equations (if possible)

Factoring Quadratic Expression in form of $ax^2 + bx + c$, $a \neq 1$, but a, b, c are integers

| | | |
|-------------------|--|--|
| $2x^2 + 5x + 3$ | | |
| $3x^2 + 7x + 4$ | | |
| $6x^2 + 5x + 1$ | | |
| $6x^2 + 11x + 1$ | | |
| $2x^2 + 7x + 5$ | | |
| $6y^2 + 19y + 8$ | | |
| $12q^2 + 17q + 6$ | | |

Activity 11: Completing the Squares, or Transforming Quadratic equation:

$y = ax^2 + bx + c$ into vertex form $y = a(x - h)^2 + k$

| | |
|--|--|
| Standard form $y = ax^2 + bx + c$ | Vertex Form $y = a(x - h)^2 + k$ |
| Question 1: Rewrite equations into the vertex form. | |
| $y = x^2 + 2x + 5$ Observation: $a = 1$ $y = x^2 + 2x + 5$ $y = x^2 + 2x + 1^2 - 1^2 + 5$ $y = (x^2 + 2x + 1^2) - 1^2 + 5$ $y = (x + 1)^2 + 5 - 1$ $y = (x + 1)^2 + 4$ | $y = (x + 1)^2 + 4$ vertex(x, y) = (h, k) = (-1, 4)  |
| $y = x^2 + 4x + 7$ | |
| $y = x^2 + 6x + 3$ | |
| Question 2: Determine the value of c, to complete the square. | |
| $y = x^2 + 6x + c$ | |
| $y = x^2 + 14x + c$ | |
| $y = x^2 - 12x + c$ | |
| $y = x^2 - 10x + c$ | |
| $y = x^2 + 2x + c$ | |
| $y = x^2 - 80x + c$ | |
| Question 3: Rewrite the equations in the form of: $y = a(x - h)^2 + k$ | |
| $y = x^2 + 6x - 1$ | |
| $y = x^2 + 2x + 7$ | |
| $y = x^2 + 10x + 20$ | |
| $y = x^2 + 2x - 1$ | |

Activity 12: Solve using Quadratic equation:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example 1: Find the real roots of an equation.

a) $2x^2 + 9x + 6 = 0$

$a = 2$

$b = 9$

$c = 6$

Substitute into formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-9 \pm \sqrt{9^2 - 4(2)(6)}}{2(2)}$$

| | |
|---|---|
| <p>a) $2x^2 + 9x + 6 = 0$</p> <p>$a = 2$</p> <p>$b = 9$</p> <p>$c = 6$</p> <p>Solve for x:</p> | <p>Activity 12:</p> <p>b) $4x^2 - 12x = -9$</p> <p>rewrite into the form: $ax^2 + bx + c = 0$</p> <p>$4x^2 - 12x + 9 = -9 + 9$</p> <p>$4x^2 - 12x + 9 = 0$</p> <p>Solve for x:</p> |
| $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ | |
| $x = \frac{-9 \pm \sqrt{9^2 - 4(2)(6)}}{2(2)}$ $x = \frac{-9 \pm \sqrt{81 - 48}}{4}$ $x = \frac{-9 \pm \sqrt{33}}{4}$ <p>The exact roots are:</p> | |

root 1:

$$x = \frac{-9 + \sqrt{33}}{4} \approx -0.81$$

root 2:

$$x = \frac{-9 - \sqrt{33}}{4} \approx -3.69$$

Activity 13: Identify all the 6 trigonometric identities.

1.

| | | | |
|-----------------------------|--------------|--|--|
| Standard Trig. Functions | Abbreviation | | |
| SOH CAH TOA | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Reciprocal Functions | | | |
| | | | |
| | | | |
| | | | |

ACTIVITY 14: - Three Primary Trigonometric Identities and their inverse.

Complete the table $\sin(\theta)$, $\cos(\theta)$, $\tan(\theta)$ of the angles in table below for angles provided.

Complete the table $\sin^{-1}(x)$, $\cos^{-1}(x)$, $\tan^{-1}(x)$ for the ratios below.

| Trigonometric Function | Abbreviation | Specific Angles θ | Value | Inverse Function | | |
|------------------------|----------------|---|---|------------------|--|--|
| sine | $\sin(\theta)$ | $\theta = 0^\circ$ $\theta = 30^\circ$ $\theta = 45^\circ$ $\theta = 60^\circ$ $\theta = 90^\circ$ add 90° to above $\theta = 120^\circ$ $\theta = 135^\circ$ $\theta = 150^\circ$ $\theta = 180^\circ$ add 90° to above $\theta = 210^\circ$ $\theta = 225^\circ$ $\theta = 240^\circ$ $\theta = 270^\circ$ add 90° to above $\theta = 300^\circ$ $\theta = 315^\circ$ $\theta = 330^\circ$ $\theta = 360^\circ$ | 0 0.5 0.7071 0.8660 1 0.8660 0.7071 0.50 0 -0.50 -0.7071 -0.8660 -1 -0.8660 -0.7071 -0.50 0 | acrsine | $\sin^{-1}(0)$ $\sin^{-1}(0.5)$ $\sin^{-1}(0.7071)$ $\sin^{-1}(0.8660)$ $\sin^{-1}(1)$ | 0° 30° 45° 59.997 1 |

| Trigonometric Function | Abbreviation | Specific Angles θ | Value | Inverse Function | | |
|------------------------|----------------|---|---|------------------|----------------|-----------|
| cosine | $\cos(\theta)$ | $\theta = 0^\circ$ $\theta = 30^\circ$ $\theta = 45^\circ$ $\theta = 60^\circ$ $\theta = 90^\circ$ add 90° to above $\theta = 120^\circ$ $\theta = 135^\circ$ $\theta = 150^\circ$ $\theta = 180^\circ$ add 90° to above $\theta = 210^\circ$ $\theta = 225^\circ$ $\theta = 240^\circ$ $\theta = 270^\circ$ add 90° to above $\theta = 300^\circ$ $\theta = 315^\circ$ $\theta = 330^\circ$ $\theta = 360^\circ$ | 1 0.8660 0.7071 0.50 0 -0.50 -0.7071 -0.8666 -1.0 0 1.0 | arccosine | $\cos^{-1}(1)$ | 0° |

| Trigonometric Function | Abbreviation | Specific Angles θ | Value | Inverse Function | | |
|------------------------|----------------|---|---|------------------|---------------|-----------|
| tangent | $\tan(\theta)$ | $\theta = 0^\circ$ $\theta = 30^\circ$ $\theta = 45^\circ$ $\theta = 60^\circ$ $\theta = 90^\circ$ add 90° to above $\theta = 120^\circ$ $\theta = 135^\circ$ $\theta = 150^\circ$ $\theta = 180^\circ$ add 90° to above $\theta = 210^\circ$ $\theta = 225^\circ$ $\theta = 240^\circ$ $\theta = 270^\circ$ add 90° to above $\theta = 300^\circ$ $\theta = 315^\circ$ $\theta = 330^\circ$ $\theta = 360^\circ$ | 0 0.57735 1 1.73205 unknown | acrtan | $\tan^{-1}()$ | 0° |

Activity 15: Find the distance between two people from the based of a flag pole.

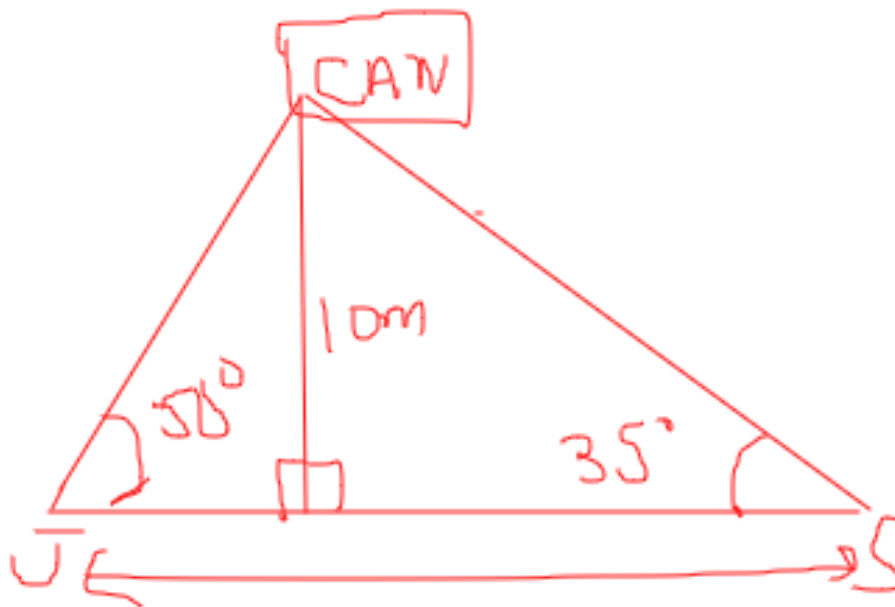
Word Problem:

Jack and Sangita are facing each other on the opposite sides of a 10-metre flagpole.

From Jack's point of view, the top of the flagpole is at an angle of elevation of 40° .

From Sangita's point of view, the top of the flagpole is at an angle of elevation of 35° .

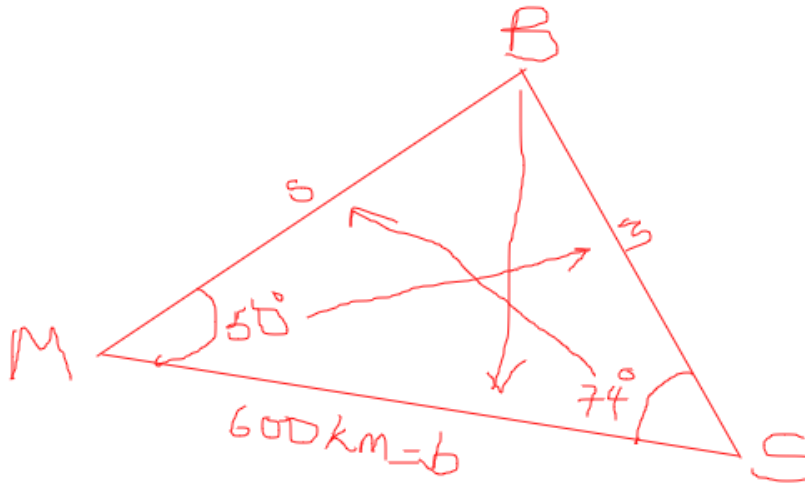
Question: How far apart are the Jack and Sangita?



Find the distance between Jack and Sangita?

Activity 16: Using the Sine Law – Find the Perimeter Length of the Bermuda Triangle:

Use the information given on the diagram to determine the perimeter of the Bermuda Triangle, to the nearest kilometer.



M is the label for the city of Miami.

B is the label for Bermuda.

S is the label for the city of San Juan of Portico Rico.

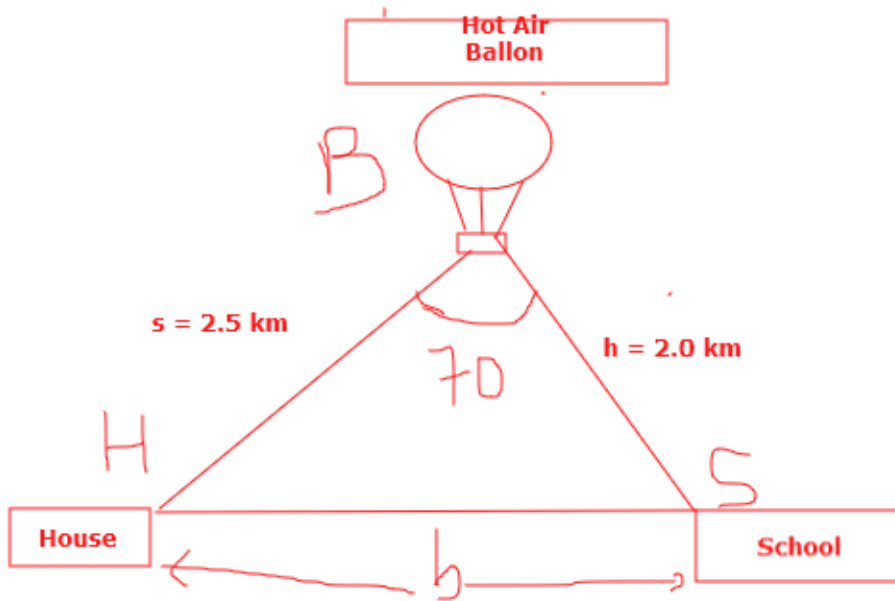
Let s is the length of distance between Miami and Bermuda.

Let m is the length in km distance between San Juan and Bermuda.

Find the Total length (Perimeter) to the nearest km.

Hint: Use the Sine Law.

Activity 17: Use the Cosine Law to find the distance between two objects:



Chandra is riding in a hot-air balloon and spots her house and her school. She estimates how far away they are from her, and the angle separating their lines of sight, as shown in above.

1. How far apart is Chandra's house and school, that is, solve for b .



THE END
OF
COURSE: MPM2D

THANK YOU!!!