

Real-World Math

Year of the Solar System

This collection of activities is based on a weekly series of space science problems distributed to thousands of teachers during the 2004-2013. They were intended for students looking for additional challenges in the math and physical science curriculum in grades 5 through 12. The problems were created to be authentic glimpses of modern science and engineering issues, often involving actual research data.

The problems were designed to be 'one-pagers' with an Answer Key as a second page. This compact form was deemed very popular by participating teachers.

This math guide was created to support the NASA/JPL Year of the Solar System (YSS) project.

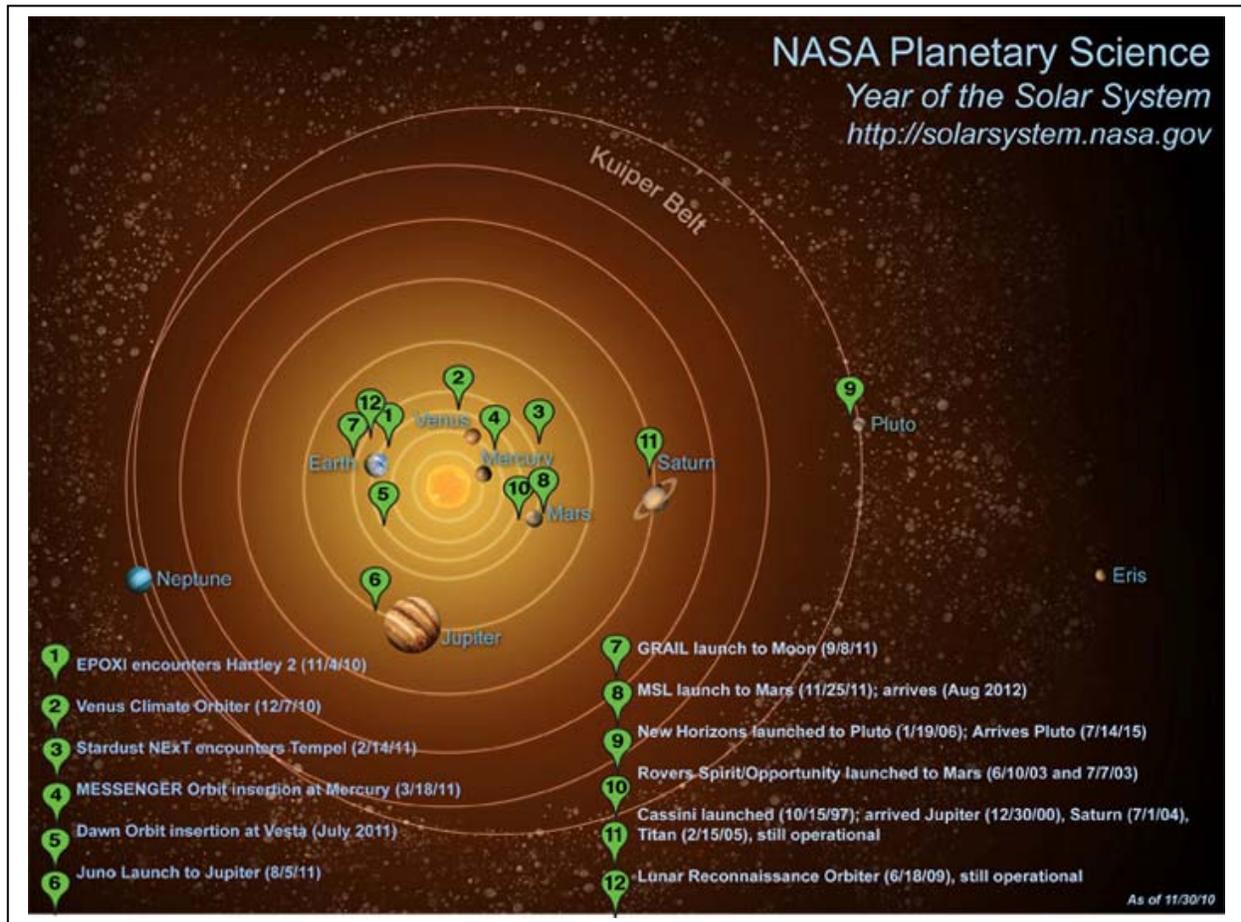
As NASA spacecraft head to, and arrive at, key locations across our solar system, YSS offers a continuing salute to the 50 year history of solar system exploration by providing an integrated picture of our new understanding of the solar system to educators and the general public!

YSS combines the amazing discoveries of past NASA planetary missions with the most recent findings of the ongoing missions, and connects them to the related planetary science topics!

This math guide offers educators and students insight into the behind-the-scenes role that mathematics plays in solar system exploration through engaging real-world problems.



For more real-world math activities about astronomy and space visit the NASA website,



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# Table of Contents

	<b>Grade</b>	<b>Page</b>
<b>Acknowledgments</b>		<b>i</b>
<b>Table of Contents</b>		<b>iii</b>
<b>Mathematics Topic Matrix</b>		<b>viii</b>
<b>Alignment with National Math and Science Standards</b>		<b>xiv</b>
<b>Associated NASA eClips Video Programs</b>		<b>xv</b>
<b>Additional Solar System Resources from SpaceMath</b>		<b>xviii</b>
<b>Multi-Media Resources from SpaceMath</b>		<b>xix</b>
<b>1.0 Scale of the Solar System</b>		
1.1 How Big is our Solar System?	5-8	
1.2 Visiting the Planets at the Speed of Light	5-8	
1.3 Travel Times by Spacecraft Around the Solar System	5-8	
1.4 A Matter of Timing	5-8	
1.5 Planetary Alignments	5-8	
1.6 Unit Conversions	5-8	
1.7 Relative Sizes of the Sun and Stars	5-8	
1.8 Scientific Notation - Beginning	9-12	
1.9 Scientific Notation - Advanced	9-12	
<b>2.0 Formation of the Solar System: Birth of Worlds</b>		
2.1 How to Build a Planet	5-8	
2.2 The Late Heavy Bombardment Era	5-8	
2.3 Timeline for Planet Formation	5-8	
2.4 How to Grow a Planet or a Raindrop	9-12	
2.5 From Dust Grains to Dust Balls	9-12	
2.6 From Dust Balls to Asteroids	9-12	
2.7 From Asteroids to Planets	9-12	
<b>3.0 The Planets -- Investigating Our Planetary Family Tree</b>		
3.1 The Relative Sizes of Planets and Other Objects	5-8	
3.2 Why are Planets Round?	5-8	
3.3 Jupiter and Io	5-8	
3.4 Planet Fractions and Scales	5-8	
3.5 How to Build a Planet	5-8	
3.6 Big Moons and Small Planets	5-8	
3.7 Finding Mass in the Cosmos	9-12	
3.8 The Distance to the Martian Horizon	9-12	
3.9 Dwarf Planets and Kepler's Third Law	9-12	
<b>4.0 Gas Giants, Atmospheres and Weather</b>		
4.1 The Composition of Planetary Atmospheres	5-8	
4.2 Measuring Atmospheric Trace Gases in PPM	5-8	
4.3 Satellite Drag and The Hubble Space Telescope	5-8	
4.4 The Martian Dust Devils	5-8	

# Table of Contents (contd)

<b>4.5 The Changing Pace of Global Warming</b>	<b>5-8</b>	
<b>4.6 Exponential Functions and Atmospheric Scale Height</b>	<b>9-12</b>	
<b>4.7 The Moon's Atmosphere</b>	<b>9-12</b>	
<b>4.8 The Io Plasma Torus</b>	<b>9-12</b>	
<b>4.9 The Changing Atmosphere of Pluto</b>	<b>9-12</b>	
<b>5.0 Moons and Rings</b>		
<b>5.1 The Rings of Saturn</b>	<b>5-8</b>	
<b>5.2 Saturn's Rings – A Closeup Study</b>	<b>5-8</b>	
<b>5.3 Saturn's Rings – Shadows from moonlets and ringlets</b>	<b>5-8</b>	
<b>5.4 Comparing Rings of the Outer Planets</b>	<b>5-8</b>	
<b>5.5 Pan's Highway and Saturn's Rings</b>	<b>5-8</b>	
<b>5.6 Orbit Speeds and Times for Saturn's Rings</b>	<b>9-12</b>	
<b>5.7 How Saturn's Moons Create the Cassini Division</b>	<b>9-12</b>	
<b>5.8 Big Moons and Small Planets</b>	<b>9-12</b>	
<b>6.0 Leftovers from Planet Building: Asteroids</b>		
<b>6.1 Asteroid Eros</b>	<b>5-8</b>	
<b>6.2 A Flyby of Asteroid Lutetia</b>	<b>5-8</b>	
<b>6.3 Dawn Sees Asteroid Vesta Up Close</b>	<b>5-8</b>	
<b>6.4 Asteroids Between Mars and the Sun</b>	<b>5-8</b>	
<b>6.5 The Closest Approach of Asteroid 2005 YU55</b>	<b>5-8</b>	
<b>6.6 The 10,000<sup>th</sup> Near Earth Object</b>	<b>9-12</b>	
<b>6.7 Close Encounter of the Asteroid Kind</b>	<b>9-12</b>	
<b>6.8 How Quickly are NEOs Discovered?</b>	<b>9-12</b>	
<b>7.0 Comets: Small Bodies / Big Impacts</b>		
<b>7.1 Temple-1: Close up of a Comet</b>	<b>5-8</b>	
<b>7.2 Comparing Comets Up Close with NASA</b>	<b>5-8</b>	
<b>7.3 Deep Impact Comet Encounter</b>	<b>5-8</b>	
<b>7.4 The Orbit of Comet ISON</b>	<b>5-8</b>	
<b>7.5 Searching for Comets</b>	<b>5-8</b>	
<b>7.6 Exploring Comet Orbits</b>	<b>5-8</b>	
<b>7.7 Computing the Orbit of a Comet</b>	<b>9-12</b>	
<b>7.8 Spotting an Approaching Comet</b>	<b>9-12</b>	
<b>7.9 Estimating the Volume of Comet Hartley-2</b>	<b>9-12</b>	
<b>8.0 Volcanism in the Solar System</b>		
<b>8.1 Volcanoes and Geysers Across the Solar System</b>	<b>9-12</b>	
<b>8.2 Io's Volcanism and Resurfacing</b>	<b>9-12</b>	
<b>8.3 Volcanoes are a Blast!</b>	<b>9-12</b>	
<b>9.0 The Sun, Transits and Eclipses</b>		
<b>9.1 Angular Sizes and Similar Triangles</b>	<b>5-8</b>	
<b>9.2 The Occulting Moons of Mars</b>	<b>5-8</b>	

## Table of Contents (contd)

v

<b>9.3</b>	<b>The Apparent Sizes of Objects Seen from Europa</b>	<b>5-8</b>	
<b>9.4</b>	<b>ISS and Sunspot Angular Sizes</b>	<b>5-8</b>	
<b>9.5</b>	<b>Eclipses, Transits and Occultations</b>	<b>5-8</b>	
<b>9.6</b>	<b>The Transit of the Moon Viewed from Space</b>	<b>5-8</b>	
<b>9.7</b>	<b>Earth and Moon Angular Sizes</b>	<b>9-12</b>	
<b>9.8</b>	<b>The Transit of Phobos Viewed from Mars</b>	<b>9-12</b>	
<b>10.0</b>	<b>Ice in the Solar System</b>		
<b>10.1</b>	<b>Asteroids and Ice</b>	<b>5-8</b>	
<b>10.2</b>	<b>Ice or Water?</b>	<b>9-12</b>	
<b>10.3</b>	<b>Is there Ice on Mercury?</b>	<b>9-12</b>	
<b>11.0</b>	<b>Gravity: It's What Keeps Us Together</b>		
<b>11.1</b>	<b>Exploring Your Weight Across the Solar System</b>	<b>5-8</b>	
<b>11.2</b>	<b>Gravity and Falling Bodies</b>	<b>5-8</b>	
<b>11.3</b>	<b>Gravity and Energy</b>	<b>5-8</b>	
<b>11.4</b>	<b>Reading a Speed Versus Time Graph</b>	<b>5-8</b>	
<b>11.5</b>	<b>Gravity and Escape Speed</b>	<b>9-12</b>	
<b>11.6</b>	<b>Exploring Artificial Gravity</b>	<b>9-12</b>	
<b>11.7</b>	<b>Distance Traveled Under Constant Acceleration</b>	<b>9-12</b>	
<b>11.8</b>	<b>Measuring Gravity with a Pendulum</b>	<b>9-12</b>	
<b>11.9</b>	<b>The Physics of Rock Throwing</b>	<b>9-12</b>	
<b>11.10</b>	<b>Grail Creates a Gravity Map of the Moon</b>	<b>9-12</b>	
<b>12.0</b>	<b>Collisions and Craters in the Solar System</b>		
<b>12.1</b>	<b>The Mars Rover Landing Site – Bonneville Crater</b>	<b>5-8</b>	
<b>12.2</b>	<b>Mercury and the Moon- Similar but Different</b>	<b>5-8</b>	
<b>12.3</b>	<b>LRO Determines Lunar Cratering History</b>	<b>5-8</b>	
<b>12.4</b>	<b>The Relative Ages of Lunar Surfaces</b>	<b>5-8</b>	
<b>12.5</b>	<b>Grail Creates Craters on the Moon</b>	<b>5-8</b>	
<b>12.6</b>	<b>Hubble Spies Colliding Asteroids</b>	<b>9-12</b>	
<b>12.7</b>	<b>The Frequency of Large Meteor Impacts</b>	<b>9-12</b>	
<b>12.8</b>	<b>The Volume of a Lunar Impact Crater</b>	<b>9-12</b>	
<b>13.0</b>	<b>Water in the Solar System</b>		
<b>13.1</b>	<b>A Model for Water Loss from Temple-1</b>	<b>5-8</b>	
<b>13.2</b>	<b>Water on Mars</b>	<b>5-8</b>	
<b>13.3</b>	<b>Avalanches on Mars</b>	<b>5-8</b>	
<b>13.4</b>	<b>Kelvin Temperatures and Very Cold Things</b>	<b>5-8</b>	
<b>13.5</b>	<b>LCROSS Sees Water on the Moon</b>	<b>5-8</b>	
<b>13.6</b>	<b>Lakes of Methane on Titan</b>	<b>5-8</b>	
<b>13.7</b>	<b>How Hot is that Planet?</b>	<b>9-12</b>	
<b>13.8</b>	<b>Stellar Temperature, Size and Power</b>	<b>9-12</b>	
<b>13.9</b>	<b>Water on the Moon</b>	<b>9-12</b>	
<b>13.10</b>	<b>A Model for the Origin of Earth's Oceans</b>	<b>9-12</b>	
<b>13.11</b>	<b>Water on Planetary Surfaces</b>	<b>9-12</b>	

## Table of Contents (contd)

<b>14.0 Planets grow and change over time: Evolving Worlds</b>		
14.1 A Timeline for Planet Formation	5-8	
14.2 The Changing Pace of Global Warming	5-8	
14.3 A Simple Model for the Origin of Earth's Oceans	9-12	
14.4 Earth's Declining Magnetism	9-12	
<b>15.0 Planetary Shields: Magnetospheres</b>		
15.1 Solar Flares	5-8	
15.2 Coronal Mass Ejections and Radiation Storms	5-8	
15.3 Magnetic Storms, Aurora and the Kp Index	5-8	
15.4 Using Math to Explore Solar Storms – word game	5-8	
15.5 Solar Storms: Odds, Fractions and Percentage	5-8	
15.6 Solar Storms – Sequences and Probability	5-8	
15.7 How Common are X-class Flares?	5-8	
15.8 Having Hot Time on Mars	5-8	
15.9 A Mathematical Model of a Magnetic Field	9-12	
15.10 Modeling Magnetic Field Lines	9-12	
15.11 Do Fast CMEs Produce Intense Radiation Storms?	9-12	
15.12 Interplanetary Shock Waves	9-12	
15.13 Giving Particles a Boost in the Van Allen Belts	9-12	
<b>16.0 Early Observations, from Telescopes to Spacecraft</b>		
16.1 How Telescopes Work	5-8	
16.2 Focal Lengths	5-8	
16.3 How Do Telescopes Magnify?	5-8	
16.4 Calculating the Magnification of a Telescope	5-8	
16.5 Light Gathering Ability – Making Faint Things Bright	5-8	
16.6 Telescope Field of View – Seeing the Big Picture	5-8	
16.7 Telescope Resolution – Seeing the Details	5-8	
16.8 Buying a Telescope	5-8	
16.9 Designing a Telescope	5-8	
16.10 Digital Camera Math	5-8	
16.11 The Webb Space Telescope : Seeing Dwarf Planets	9-12	
16.12 The Most Important Equation in Astronomy !	9-12	
<b>17.0 Our Evolving Understanding of the Solar System</b>		
17.1 Hubble Sees a Dwarf Planet Clearly	5-8	
17.2 Methane Lakes on Titan	5-8	
17.3 Hubble Sees a Distant Planet	5-8	
17.4 Global Warming and the Sun's Evolving Luminosity	9-12	
17.5 Exploring the Solar System Beyond Neptune	9-12	
17.6 The Temperature of Earth without Carbon Dioxide	9-12	

## Table of Contents (contd)

<b>18.0 Robotic Spacecraft: Far-Ranging Robots</b>		
18.1 Curiosity Heads for Mount Sharp	5-8	
18.2 Taking a Stroll Around a Martian Crater	5-8	
18.3 Exploring Gale Crater with Curiosity	5-8	
18.4 Curiosity Rover on the Move	5-8	
18.5 InSight Telemetry Data	5-8	
18.6 Radio Communication with Earth	9-12	
18.7 Curiosity Discovers an Ancient Martian River	9-12	
18.8 Curiosity Uses X-Ray Diffraction to Identify Minerals	9-12	
<b>19.0 The search for planets: Discovering New Worlds</b>		
19.1 Transits and Brightness Change	5-8	
19.2 Kepler's First Look at Transiting Exoplanets	5-8	
19.3 Earth-like Planets by the Score!	5-8	
19.4 Comparing Planets Orbiting Other Stars	5-8	
19.5 Kepler – The Hunt for Earth-like Planets	5-8	
19.6 The Earth-like Planet Gliese 581g	5-8	
19.7 The Evaporating Cometary Planet HD 209458b	9-12	
19.8 Kepler 10b – A matter of Gravity	9-12	
19.9 Playing Baseball on Kepler 22b	9-12	
19.10 Exoplanet Orbits and the Properties of Ellipses	9-12	
19.11 Estimating the Temperature of an Exoplanet	9-12	
<b>20.0 Astrobiology -- Are We Alone in the Universe?</b>		
20.1 The Goldilocks Planets	5-8	
20.2 Discovering Earth-like Planets by their Color	5-8	
20.3 The Composition of Planetary Atmospheres	5-8	
20.4 Organic Molecules Detected on a Distant Planet	9-12	
20.5 The Atmosphere of Super-Earth GJ 1214b	9-12	
20.6 Alpha Centauri Bb – A Nearby Planet	9-12	
20.7 Searching for Company in the Universe	9-12	
20.8 Extracting Oxygen from Moon Rocks	9-12	
20.9 An Organism Based on Arsenic not Phosphorus	9-12	

# Mathematics Topic Matrix

Topic	Problem Numbers																														
	1.0									2.0							3.0									4.0					
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6
Inquiry									X																						
Technology, rulers									X										X												X
Numbers, patterns, percentages	X			X	X					X	X					X	X		X		X				X	X					
Averages																															
Time, distance, speed	X	X									X																				X
Areas and volumes									X	X								X			X										
Scale drawings							X											X	X	X			X							X	
Proportions	X						X									X	X	X													
Geometry		X			X															X			X								
Scientific Notation					X		X	X				X	X	X	X								X	X						X	
Unit Conversions					X																										
Fractions																															
Graph or Table Analysis									X							X	X						X				X		X		
Solving for X																														X	
Evaluating Fns												X	X	X	X								X							X	
Modeling												X	X	X	X	X			X				X	X							
Probability																															
Rates/Slopes																											X	X			
Logarithmic Fns																														X	
Polynomials																								X							
Power Fns																								X							
Conics																															
Trigonometry																															
Integration												X	X	X	X																
Differentiation												X	X	X	X																
Limits																															

## Mathematics Topic Matrix (cont'd)

Topic	Problem Numbers																													
	4.0			5.0								6.0								7.0								8.0		
	7	8	9	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	1	2
Inquiry																														
Technology, rulers				X	X	X	X					X	X	X	X					X					X					
Numbers, patterns, percentages											X										X			X						
Averages																														
Time, distance, speed													X		X	X														
Areas and volumes	X	X		X																		X							X	
Scale drawings				X	X	X	X					X	X	X	X	X				X	X			X	X					
Proportions				X	X						X	X	X	X						X				X						
Geometry													X		X				X					X			X			
Scientific Notation	X	X	X	X						X												X								X
Unit Conversions	X																													
Fractions																														
Graph or Table Analysis				X												X	X					X								
Solving for X																														
Evaluating Fns			X						X	X																			X	X
Modeling																						X							X	
Probability																														
Rates/Slopes															X								X	X					X	
Logarithmic Fns																		X									X			
Polynomials																														
Power Fns																														
Conics			X																				X	X	X					
Trigonometry					X																									
Integration		X																										X		
Differentiation																														
Limits																														

## Mathematics Topic Matrix (cont'd)

Topic	Problem Numbers																														
	9.0								10.0			11.0									12.0										
	1	2	3	4	5	6	7	8	1	2	3	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8		
Inquiry					X																					X					
Technology, rulers						X					X											X	X	X		X					
Numbers, patterns, percentages									X																				X		
Averages																															
Time, distance, speed																X	X											X			
Areas and volumes									X		X												X	X		X	X	X			
Scale drawings	X					X	X															X	X	X	X						
Proportions	X	X	X			X		X				X										X	X	X							
Geometry	X				X	X	X																					X			
Scientific Notation									X	X	X																	X			
Unit Conversions																															
Fractions	X	X	X																												
Graph or Table Analysis						X								X														X			
Solving for X		X	X										X																		
Evaluating Fns					X													X	X	X	X							X			
Modeling						X	X					X	X		X	X													X		
Probability																															
Rates/Slopes										X		X							X	X											
Logarithmic Fns																															
Polynomials																													X		
Power Fns																															
Exponential Fns																															
Conics																															
Trigonometry																															
Integration																												X	X		
Differentiation																															
Limits																															



# Mathematics Topic Matrix (cont'd)

Topic	Problem Numbers																												
	16.0										17.0						18.0												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	1	2	3	4	5	6	7	8			
Inquiry																													
Technology, rulers												X	X	X						X									
Numbers, patterns, percentages	X														X														
Averages																				X									
Time, distance, speed																				X	X	X	X			X			
Areas and volumes	X				X					X		X	X			X	X			X									
Scale drawings																					X	X			X				
Proportions			X	X		X	X	X	X																				
Geometry	X																			X	X				X				
Scientific Notation												X				X													
Unit Conversions	X								X		X	X																	
Fractions																													
Graph or Table Analysis									X		X				X					X	X		X						
Solving for X		X	X	X			X	X	X																				
Evaluating Fns										X	X				X										X				
Modeling																													
Probability																													
Rates/Slopes														X						X	X	X	X	X					
Logarithmic Fns																													
Polynomials																													
Power Fns																													
Exponential Fns																													
Conics																													
Trigonometry																	X								X				
Integration																													
Differentiation																													
Limits																													

# Mathematics Topic Matrix (cont'd)

Topic	Problem Numbers																			
	19.0										20.0									
	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	
Inquiry																	X	X		
Technology, rulers					X															
Numbers, patterns, percentages	X	X	X	X		X	X			X	X	X					X	X		
Averages																				
Time, distance, speed																				
Areas and volumes	X						X							X	X					
Scale drawings						X	X													
Proportions				X																
Geometry																				
Scientific Notation							X	X	X	X			X	X	X					
Unit Conversions																				
Fractions																				
Graph or Table Analysis	X	X	X							X	X			X	X					
Solving for X																				
Evaluating Fns							X	X	X						X					
Modeling							X	X						X		X				
Probability		X								X										
Rates/Slopes																	X	X		
Logarithmic Fns																				
Polynomials																				
Power Fns																				
Exponential Fns																				
Conics								X	X											
Trigonometry																				
Integration																				
Differentiation																				
Limits																				

## Next Generation Science Standards

### **MS-ESS1 Earth's Place in the Universe**

- **Performance Expectation: MS-ESS1-3**
  - Analyze and interpret data to determine scale properties of objects in the solar system.

### **HS – ESS1 Earth's Place in the Universe**

- **Performance Expectations: HS-ESS1-1**
  - Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy in the form of radiation.
- **Performance Expectations: HS-ESS1-4**
  - Use mathematical or computational representations to predict the motion of orbiting objects in the solar system

## CCMS: Common Core Mathematics Standards

### **Grades 6–8**

**CCSS.Math.Content.7.RP.A.2c** Represent proportional relationships by equations

**CCSS.Math.Content.6.EE.A.2c** Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems

**CCSS.Math.Content.6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots

**CCSS.Math.Content.7.G.A.1** Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

**CCSS.Math.Content.8.EE.A.4** Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.

**CCSS.Math.Content.8.EE.C.7b** Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

**CCSS.Math.Content.8.EE.C.8c** Solve real-world and mathematical problems leading to two linear equations in two variables

### **Grades 9–12**

**CCSS.Math.Content.HSN-RN.A.1** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents

**CCSS.Math.Content.HSN-Q.A.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

**CCSS.Math.Content.HSA-SSE.B.3c** Use the properties of exponents to transform expressions for exponential functions.

**CCSS.Math.Content.HSA-CED.A.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

**CCSS.Math.Content.HSF-TF.A.1** Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

**CCSS.Math.Content.HSG-GPE.A.3 (+)** Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

## **Space Math**

# Associated NASA eClips Video Programs



**NASA eClips**, developed by the National Institute of Aerospace (NIA), consists of over 200 short video programs (3-10 minutes) featuring a variety of NASA missions and other topical resources. The videos are narrated by students making the content more easily accessible to grades 3 – 12 students.

Programs are available at :  
<http://www.nasa.gov/audience/foreducators/nasaclips/index.html>

Topic	NASA eClips Connection	Link
<b>1.0 Scale of the Solar System</b>	<b>RealWorld -- Scale Models and Ratios:</b> This NASA video segment explains scale models, ratios, proportions and how to calculate problems with different units of measurement. Color animations clarify the use of ratios.	<a href="http://tinyurl.com/njnbl9e">http://tinyurl.com/njnbl9e</a>
<b>2.0 Formation of the Solar System: Birth of Worlds</b>	<b>Our World -- Stardust:</b> Visit a lab at NASA's Johnson Space Center where scientists study meteorites. Learn how aerogel, the lightest material in the world helped capture pieces of a comet and return the comet dust to Earth. See what scientists can learn about our universe from these tiny particles.	<a href="http://tinyurl.com/ozt85pb">http://tinyurl.com/ozt85pb</a>
<b>3.0 The Planets – Investigating Our Planetary Family Tree</b>	<b>Our World -- Pluto:</b> With more powerful telescopes, scientists are discovering smaller objects in our solar system. Find out how scientists now classify planets. See how NASA's robotic spacecraft, New Horizons, will help us learn more about the dwarf planet Pluto and similar objects in the Kuiper Belt.	<a href="http://tinyurl.com/pm7slqn">http://tinyurl.com/pm7slqn</a>
<b>4.0 Gas Giants, Atmospheres and Weather</b>	<b>Launchpad -- Global Warming:</b> Learn how the greenhouse effect keeps more of the sun's heat and energy within Earth's atmosphere causing temperatures on Earth to rise. This video explains the effect warmer temperatures are playing on Earth.	<a href="http://tinyurl.com/omalvln">http://tinyurl.com/omalvln</a>
<b>5.0 Moons and Rings</b>	<b>Our World -- Moons in Our Solar System:</b> Did you know astronomers have identified more than 300 moons in our solar system? How big is Ganymede? How small is Deimos? Which moons might have what it takes to support life? Follow the NASA missions to learn about these unique bodies in space.	<a href="http://tinyurl.com/ock4sp7">http://tinyurl.com/ock4sp7</a>
<b>6.0 Leftovers from Planet Building: Asteroids</b>	<b>Our World – What is the Solar System?</b> Find out why one amateur astronomer created an amazing graphic of the 88 largest objects in our solar system. Learn just what makes up a solar system and find out how we classify the thousands of objects in our own solar system.	<a href="http://tinyurl.com/prmjgmb">http://tinyurl.com/prmjgmb</a>

<p><b>7.0 Comets: Small Bodies/Big Impacts</b></p>	<p><b>Real World – Comets:</b> NASA engineers are finding new uses for old spacecraft as a way to study comets. Find out how a repurposed spacecraft can return to a comet for a second visit to uncover secrets about the formation of the solar system. Use angular size to see just how big this comet really is!</p>	<p><a href="http://tinyurl.com/orygk6q">http://tinyurl.com/orygk6q</a></p>
<p><b>8.0 Volcanism in the Solar System</b></p>	<p><b>Real World – Choosing the Right Lunar Excavator:</b> See how NASA engineers use the design process to evaluate the best choice for a new lunar excavator. Three different models are tested on location in Hawaii where the soil on Mauna Kea Volcano is similar to that on the moon.</p>	<p><a href="http://tinyurl.com/qeyowbc">http://tinyurl.com/qeyowbc</a></p>
<p><b>9.0 The Sun, Transits and Eclipses</b></p>	<p><b>Launchpad – Solar Eclipses:</b> Join NASA to learn more about solar eclipses, especially the awe-inspiring phenomenon of total eclipses. Find out about the geometry and the distances and sizes of the sun and moon as seen from Earth that allow us to witness the sun's corona or actually be in the path of totality.</p>	<p><a href="http://tinyurl.com/phsebts">http://tinyurl.com/phsebts</a></p>
<p><b>10.0 Ice in the Solar System</b></p>	<p><b>Launchpad – Thin Ice:</b> Join teacher scientists as they learn what ice can tell us about the history of winter. Find out why NASA studies ice and what thin ice sections observed through polarizing filters can help us learn. See how to use bubble patterns in ice core samples to show long-term weather patterns.</p>	<p><a href="http://tinyurl.com/ppaf66y">http://tinyurl.com/ppaf66y</a></p>
<p><b>11.0 Gravity: It's What Keeps Us Together</b></p>	<p><b>Our World – Gravity in Space:</b> What is gravity? Find out about the balance between gravity and inertia that keeps the International Space Station in orbit. Learn why astronauts "float" in space and how the space shuttle has to slow down in order to come back to Earth.</p>	<p><a href="http://tinyurl.com/pagm483">http://tinyurl.com/pagm483</a></p>
<p><b>12.0 Collisions and Craters in the Solar System</b></p>	<p><b>Real World – Lunar Reconnaissance Orbiter Mission:</b> Join NASA scientists for a look at the new Lunar Reconnaissance Orbiter, or LRO. Find out about the instruments that will make a comprehensive map of the moon and search for safe landing sites by collecting unprecedented amounts of data.</p>	<p><a href="http://tinyurl.com/ns7qlfx">http://tinyurl.com/ns7qlfx</a></p>
<p><b>13.0 Water in the Solar System</b></p>	<p><b>Our World – Life on Other Worlds:</b> Explore the possibility of finding life on other planets. See how NASA's search for water on Mars proved successful with the Phoenix Lander. Find out about extremophiles and what makes a habitable zone for life as we know it.</p>	<p><a href="http://tinyurl.com/pgyhu6p">http://tinyurl.com/pgyhu6p</a></p>
<p><b>14.0 Planets grow and change over time</b></p>	<p><b>Our World – Traveling to the Moon and Mars:</b> This video segment calculates the distance from Earth to the moon and from Earth to Mars. It also analyzes the temperature and surface of other planets and explains why Mars is targeted for human exploration.</p>	<p><a href="http://tinyurl.com/qbmts4w">http://tinyurl.com/qbmts4w</a></p>

<p><b>15.0 Planetary Shields: Magnetospheres</b></p>	<p><b>Our World – The Sun, a Real Star:</b> Learn about the important relationship between Earth and the sun. Find out about the layers of the sun and how Earth's magnetosphere acts like a giant handkerchief to protect us from all kinds of space weather.</p>	<p><a href="http://tinyurl.com/o2jooyq">http://tinyurl.com/o2jooyq</a></p>
<p><b>16.0 Early Observations, from Telescopes to Spacecraft</b></p>	<p><b>Our World – Early Hubble History:</b> Learn how the Hubble Space Telescope has changed the way scientists look at the universe, without the interference of Earth's atmosphere. Find out how this telescope works and a bit of history about the man for whom it is named.</p>	<p><a href="http://tinyurl.com/p9xcr3c">http://tinyurl.com/p9xcr3c</a></p>
<p><b>17.0 Our Evolving Understanding of the Solar System</b></p>	<p><b>Launchpad – Methane - An Indicator for Life?</b> What is the shape of our heliosphere and what lies beyond? How does interstellar medium affect the heliosphere? To find out, NASA launched the Interstellar Boundary Explorer, or IBEX, to map out the boundaries of our solar system.</p>	<p><a href="http://tinyurl.com/qjehwok">http://tinyurl.com/qjehwok</a></p>
<p><b>18.0 Robotic Spacecraft: Far-Ranging Robots</b></p>	<p><b>Launchpad – Curiosity Goes to Mars:</b> Find out why Curiosity is the best name for the largest rover ever sent to another planet. Learn about the challenges of landing on a planet with an atmosphere and the geology and chemistry questions scientists hope to answer with instruments on the Mars Science Laboratory.</p>	<p><a href="http://tinyurl.com/nta9qda">http://tinyurl.com/nta9qda</a></p>
<p><b>19.0 The search for planets: Discovering New Worlds</b></p>	<p><b>Launchpad – Kepler:</b> Join NASA on the Kepler Mission as this traveling telescope images the light from faraway stars to locate Earth-sized and smaller planets. Using the transit method, the Kepler telescope measures the brightness of a star and uses the data to predict habitable zones.</p>	<p><a href="http://tinyurl.com/qhokfjv">http://tinyurl.com/qhokfjv</a></p>
<p><b>20.0 Astrobiology- Are We Alone in the Universe?</b></p>	<p><b>Launchpad – Astrobiology:</b> Are we alone in the universe? Where do we come from? Join NASA in the search for answers to these and many more questions about life in our solar system. Learn how astrobiologists use what we know about Earth to investigate Titan, Europa and other far-off worlds.</p>	<p><a href="http://tinyurl.com/o3b62xa">http://tinyurl.com/o3b62xa</a></p>

**Solar Math** (2012). This is a revised and expanded version of the book *Hinode Math* (2008), featuring problems about the sun from many NASA science missions. The activities explore solar storms and solar structure using simple math activities. Problems range from calculating the sizes of sunspots from photographs, to investigating solar magnetism, the sunspot cycle, and solar storms using algebra and geometry. Suitable for students in grades 6-12. [99 Problems PDF: 15.7 Mby]

**Lunar Math** (2012). This is a revised and expanded version of *Lunar Math* (2008) that includes many problems for grades 3-5, as well as more challenging problems for older students. An exploration of the moon using NASA photographs and scaling activities including mathematical modeling of the lunar interior, and problems involving estimating the total mass of the moon and its atmosphere. [56 Problems PDF: 13.8 Mby ]

**Earth Math** (2009). Students explore the simple mathematics behind global climate change through analyzing graphical data, data from NASA satellites, and by performing simple calculations of carbon usage using home electric bills and national and international energy consumption. [46 Problems PDF: 4.2 Mby ]

**Space Weather Math** (2010). Students explore the way in which the sun interacts with Earth to produce space weather, and the ways in which astronomers study solar storms to predict when adverse conditions may pose a hazard for satellites and human operation in space. Six appendices and an extensive provide a rich 150-year context for why space weather is an important issue. [96 Problems PDF: 26.1 Mby ]

**Transit Math** (2010). Students explore astronomical eclipses, transits and occultations to learn about their unique geometry, and how modern observations by NASA's Kepler Satellite will use transit math to discover planets orbiting distant stars. A series of Appendices reveal the imagery and history through news paper articles of the Transits of Venus observed during the 1700 and 1800s. [44 Problems PDF: 14.6 Mby ]

**Remote Sensing Math** (2011). This book covers many topics in remote sensing, satellite imaging, image analysis and interpretation. Examples are culled from earth science and astronomy missions. Students learn about instrument resolution and sensitivity as well as how to calibrate a common digital camera, and how to design a satellite imaging system. [103 Problems PDF: 15.2 Mby ]

**Astrobiology Math** (2011). This book introduces many topics in the emerging subject of astrobiology: The search for life beyond Earth. It covers concepts in evolution, the detection of extra-solar planets, habitability, Drake's Equation, and the properties of planets such as temperature and distance from their star. [75 Problems PDF: 33.2 Mby ]

**Mars Math** (2012). An introduction to the planet Mars and some of the NASA missions that have studied this planet and its surface, including the Spirit and Opportunity Rovers and the much-awaited Curiosity Rover. Problems include basic scales and proportions, fractions, scientific notation, algebra and geometry. [24 Problems PDF: 7.7 Mby ]

**Exploring Planetary Moons** (2013). This collection of activities is intended for students looking for additional challenges in the math and physical science curriculum in grades 3 through 6, but where the topics are drawn from astronomy and space science. This book introduces students to some of the most unusual places in our solar system that are not planets. Using simple proportional relationships and working with fractions, they will study the relative sizes of the larger moons in our solar system, and explore how temperatures change from place to place using the Celsius and Kelvin scales. [22 Problems PDF: 4.4 Mby ]

**These books are available at:**

**<http://spacemath.gsfc.nasa.gov/books.html>**

**Grade- 6**

- Chapter 3 - **Understanding Decimals** - Students will learn about the Cassini mission and its exploration of Saturn's moons through reading a NASA press release. By viewing a NASA eClips video segment, students will learn more about these and other moons in our solar system. Then students will use decimals to compare the sizes and distances of Saturn's moons to the center of Saturn. Featured NASA Missions: Cassini
- Chapter 4 - **Number Theory and Fractions** - Students will learn about the Juno mission and its exploration of Jupiter, a giant gas planet, through reading a NASA press release. By viewing a NASA eClips video segment, students will visualize Jupiter and the other 88 largest objects in our solar system. Then students will use fractions to compare Jupiter's moons and movements. Featured NASA Missions: Juno
- Chapter 6 - **Data Collection** - During the last sunspot cycle between 1996-2008, over 21,000 flares and 13,000 clouds of plasma exploded from the sun's magnetically active surface. These events create space weather. Students will learn more about space weather and how it affects Earth through reading a NASA press release and viewing a NASA eClips video segment. Then students will explore the statistics of various types of space weather storms by determining the mean, median and mode of a sample of storm events. Featured NASA Missions: SDO, ACE, STEREO
- Chapter 8 - **Measurement and Geometry** - Students learn how solar panels can be used to generate electrical power and how the size and area of the panels affects energy production. By reading a NASA press release and viewing a NASA eClips video segment, students see how solar energy is used by various NASA satellites and technology. Featured NASA Missions: Juno

**Grade- 7**

- Chapter 2 - **Integer Arithmetic** - Students will explore how methane molecules are produced from larger molecules, and how NASA is using signs of methane gas to search for life on other planets such as Mars. Students will read a NASA press release and view a NASA eClips video segment. Then students will use integer arithmetic to tally the number of hydrogen, oxygen and carbon atoms in a molecule and determine the number of methane atoms that can result. Featured NASA Missions: Mars Science Laboratory
- Chapter 4 - **Scale Models and Diagrams** - Students will learn more about the Lunar Reconnaissance Orbiter (LRO) through reading a NASA press release and viewing a NASA eClips video segment. Then students will explore scale modeling by measuring scaled drawings using high-resolution images of the lunar and martian surfaces. Featured NASA Missions: LRO, Opportunity Rover
- Chapter 7 - **Mean, Median and Mode** - During the last sunspot cycle between 1996-2008, over 21,000 flares and 13,000 clouds of plasma exploded from the sun's magnetically active surface. Students will learn more about space weather through reading a NASA press release and viewing a NASA eClips video segment. Then students will explore the statistics of various types of space weather storms by determining the mean, median and mode of different samples of storm events. Featured NASA Missions: SDO
- Chapter 8 - **Angular Measure** - Students will learn about the Transit of Venus through reading a NASA press release and viewing a NASA eClips video that describes several ways to observe transits. Then students will study angular measurement by learning about parallax and how astronomers use this geometric effect to determine the distance to Venus during a Transit of Venus. Featured NASA Missions: Kepler, SDO

**Grade -7**

- Chapter 9 - **The Volume of Spheres and Cylinders** - Students will learn more about asteroids and comets through reading a NASA press release and viewing a NASA eClips video segment. Then, students will estimate and calculate volumes of comets, asteroids, and spacecraft. Featured NASA Missions: Dawn
- Chapter 10 - **Probability and Predictions** - Students will learn about the NASA Kepler mission and Earth-like planet discoveries through reading a NASA press release. They will also view a NASA eClips video describing the search for planets beyond our solar system. Then, students will study the statistics of planets outside our solar system and estimate the number of Earth-like planets in the Milky Way galaxy. Featured NASA Missions: Kepler

**Grade – 8**

- Chapter 1 - **Rational Number Operations** - Students will learn about the twin STEREO spacecraft and how they are being used to track solar storms through reading a NASA press release and viewing a NASA eClips video segment. Then students will examine data to learn more about the frequency and speed of solar storms traveling from the sun to Earth. Featured NASA Missions: STEREO
- Chapter 2 - **Graphs and Functions** - Students will learn about NASAs Radiation Belt Storm Probes (RBSP), Earths van Allen Radiation Belts, and space weather through reading a NASA press release and viewing a NASA eClips video segment. Then students will use simple linear functions to examine the scale of the radiation belts and the strength of Earths magnetic field. Featured NASA Missions: RBSP
- Chapter 4 - **Ratios, Proportions, Similarity** - Students will learn about the planet Mercury and the MESSENGER mission through reading a NASA press release and viewing a NASA eClips video segment. Then students will perform calculations using fractions and decimals to explore the relative sizes of planets in our solar system and orbiting other stars. Featured NASA Missions: MESSENGER
- Chapter 5 - **Geometry and Angle Properties** - Students will learn about the Mars Science Laboratory (MSL) and the Curiosity Rover through reading a NASA press release and viewing a NASA eClips video segment. Then students will use the Pythagorean Theorem to determine distance between a series of hypothetical exploration sites within Gale Crater on Mars. Featured NASA Missions: Curiosity
- Chapter 7 - **Multi-Step Equations** - Students will learn how NASA uses different types of power systems to generate electricity through reading a NASA press release and viewing a NASA eClips video segment. Then students will solve a series of problems involving multi-step equations to explore these systems in more detail. Featured NASA Missions: Cassini, Mars Science Laboratory

These resources are available at the STEM Modules resource for SpaceMath@NASA located at

<http://spacemath.gsfc.nasa.gov/media.html>

# YEAR OF THE SOLAR SYSTEM

- Home
- Topics
- Labels
- Abstracts
- Get Involved
- Downloads
- Friends & Partners
- Missions
- Calendar



## Science Topics

**How did our Sun's family of planets and bodies originate?**

The Journey Begins	Birth of Worlds	A Family Affair
 <p><i>Scale of the Solar System</i></p>	 <p><i>Formation of the Solar System</i></p>	 <p><i>The Planets -- Investigating Our Planetary Family Tree</i></p>

**How has our solar system evolved to its current diverse state?**

Windy Worlds	Our Favorite Things	Asteroids	Small Bodies / Big Impacts
 <p><i>Gas Giants, Atmospheres and Weather</i></p>	 <p><i>Moons and Rings</i></p>	 <p><i>Leftovers from Planet Building</i></p>	 <p><i>Comets</i></p>
Hot Stuff!	Shadows of the Sun	Ice!	It's What Keeps Us Together
 <p><i>Volcanism in the Solar System</i></p>	 <p><i>The Sun, Transits and Eclipses</i></p>	 <p><i>Ice in the Solar System</i></p>	 <p><i>Gravity</i></p>
Impacts!	Water, Water, Everywhere!	Evolving Worlds	Magnetospheres
 <p><i>Collisions and Craters in the Solar System</i></p>	 <p><i>Water in the Solar System</i></p>	 <p><i>Planets, like people, grow and change over time</i></p>	 <p><i>Planetary Shields</i></p>

<http://solarsystem.nasa.gov/yss/topics.cfm>



National Aeronautics and Space Administration  
Goddard Space Flight Center

Flight Projects | Sciences and Exploration

## Space Math @ NASA

Home
Problem Books
STEM Modules
Inquiry

**Space Math @ NASA**

SpaceMath@NASA introduces students to the use of mathematics in today's scientific discoveries. Through press releases and other articles, we explore how many kinds of mathematics skills come together in exploring the universe.

**Partnering NASA Missions**

**Astrophysics:**

- Chandra - [Click here](#)
- Kepler - [Click here](#)
- James Webb ST - [Click here](#)

**Earth Science:**

- SAGE-III - [Click here](#)
- History of Winter- [Click here](#)
- S'COOL- [Click here](#)

**Heliophysics:**

- Hinode - [Click here](#)
- IMAGE - [Click here](#)
- MMS - [Click here](#)
- RBSP - [Click here](#)
- THEMIS - [Click here](#)

**SpaceMath@NASA News Updates**

**March 2012:** NASA [Press Release](#) about SpaceMath@NASA- [[Read Press Release](#)]

**April 2013:** The 7 millionth Space Math problem is downloaded

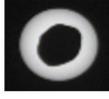
**August 2013:** Updated Website for 2013-2014 school year.

**Math in the News**

A behind-the-scenes look at the math in NASA press releases



**Problem 607: The Launch of LADEE to the Moon**  
Students plot the altitude, range and speed of the LADEE rocket launch and investigate rates of change including acceleration by graphing the tabular data and determining the slope of the graph using the definition of the slope of a line between two points. (PDF)



**Problem 601: The Transit of Phobos Across the Sun Viewed by Curiosity**  
Angular measure is used to determine the apparent sizes of objects in the sky. Students work with angular measure to determine the angular sizes of the sun and Phobos as viewed from the surface of Mars. (PDF)



**Problem 561: Exploring the Evaporating Exoplanet HD189733b**  
Some planets orbit so close to their star that they begin to evaporate because of the enormous solar heating. Students estimate the remaining life of this evaporating planet. (PDF)

**STEM Multi-Media Modules**



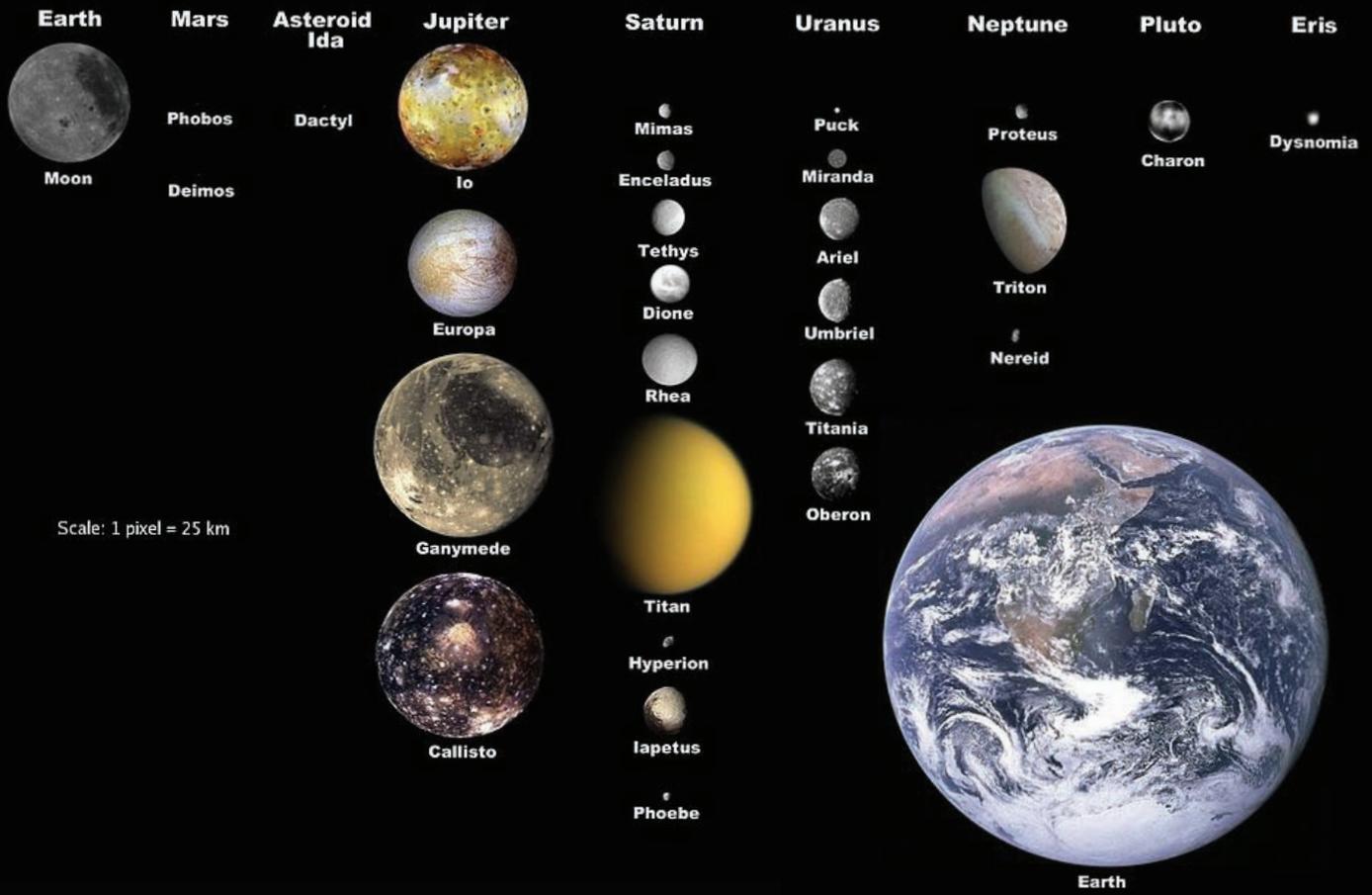
**Grades 6, 7 and 8:** Standards-based, multi-media math resources featuring NASA eClips video segments, readings from NASA press releases, online interactive resources, and of course math problems!  
[\[click here\]](#)

**Problem Archives**

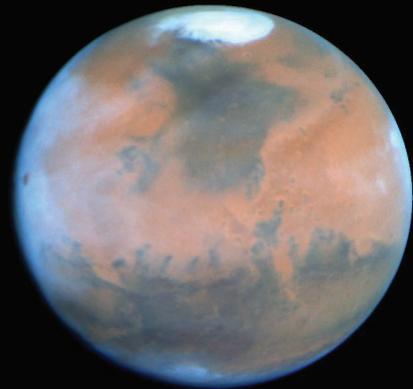
- I - Problems 1 to 38
- II - Problems 39 to 64
- III - Problems 65 to 101
- IV - Problems 102 to 148
- V - Problems 149 to 233
- VI - Problems 234 to 342
- VII - Problems 343 to 428
- VIII - Problems 429 to 478
- IX - Problems 479 to 536
- X - Problems 537 to Present

Space Math

# Selected Moons of the Solar System, with Earth for Scale



Scale: 1 pixel = 25 km



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