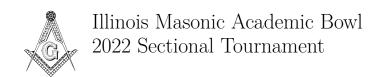## Question #1: Mathematics

10 points

One theory behind the development of this unit of measure combines the use of equilateral triangles and a sexagesimal ["sex"-uh-JESS-ih-mull] numeric system. Though it is common to use this unit of measure for many applications, this unit is generally avoided in calculus because trigonometric derivatives are not simple with this unit. Though this unit does not measure time, it can be divided into minutes and seconds. 90 of these units equals 100 gradians. Approximately 57.3 of these units is equal to one radian; the exact conversion is 180 over pi. Name this unit used for angles that divides a circle into 360 parts.	**degree**s

Question #2: Social Studies

10 points

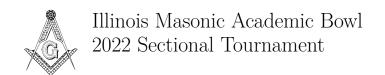| This leader's career ended when he was put under house arrest by Ta Mok. While in power, this person used the phrase "Brother Number Two" to refer to Nuon Chea [nohn chay]. Under this person's leadership, people from cities were referred to as "New People", and the slogan used on them was "To keep you is no profit; to destroy you is no loss." After Prince Sihanouk [SEE-uh-nook] was overthrown by Lon Nol, this person led a civil war effort that resulted in him becoming the Prime Minister. He lost that title after a series of border fights with Vietnam. Name this Khmer Rouge [k'mair roozh] leader blamed for killing one-fourth of his country in the Killing Fields in Cambodia.	Pol **Pot** or **Saloth** Sar

Question #3: Literature

10 points

In transliterations from some languages into English, this punctuation mark is used to represent glottal stops or palatalizations [PAL-uh-tul-uh-ZAY-shunz]. The "prime" symbol used in math and as a symbol for feet is very similar to this punctuation mark, so this mark is sometimes used instead. This punctuation mark is used when pluralizing a single letter or number. Name this punctuation mark that is most commonly used in contractions and to show possession.	**apostrophe**(s)

Question #4: Science

10 points

A scientific instrument named for this phenomenon is used to study crystal structures, often along with a Bernal [BUR-nul] chart. The pattern formed by this phenomenon is the same in some ways whether it is caused by an object or a space according to Babinet's [bab-ee-nay'z] principle. The Fresnel [freh-nel] equation describes the near-field type of this phenomenon, and the Fraunhofer [FRAUN-hau-fur] equation describes the far-field type. This phenomenon explains why pictures taken with a small aperture are less focused. Many spectrometers use a grating that produces this phenomenon. Name this bending of light when light goes around a barrier or through a hole.	**diffract**ion or **diffract**ing or **diffract**ometer [do not accept **refract**ion]

Question #5: Miscellaneous

10 points

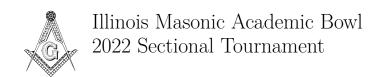|	
On the television show *Gossip Girl*, Nelly broke up with her boyfriend at a concert by this rapper. A 2012 song by this rapper begins by sampling the Etta James song "Something's Got a Hold on Me," followed by him singing the lyrics "Yes I can, doubt better leave, I'm running with this plan." Another song by this rapper has an opening by Sia [SEE-uh] followed by the lyrics "I like crazy, foolish, stupid, party-going-wild, fist-pumping music." Kesha's [KESH-uh'z] career took off after she was featured on this rapper's song "Right Round". Name this rapper who sang "Good Feeling" and "Wild Ones" and whose stage name reflects the state he is from.	Flo **Rida** [or Tramar Lacel **Dillard**]

Question #6: Social Studies

10 points

The effect of the 14th Amendment on this other amendment was clarified in *Gregg v. Georgia*, which was an attempt to extend the application of this amendment in *Furman v. Georgia*. A different clause in this Amendment was clarified by *United States v. Bajakajian [bah-juh-KAH-jee-un]*, which was based on a person leaving the United States without reporting that he was taking an amount over 10,000 dollars. Justice Earl Warren wrote that this constitutional amendment should be applied with "evolving standards of decency". This amendment has been the basis of several decisions about the death penalty. Name this amendment that prohibits excessive bail, excessive fines, and cruel and unusual punishment.	**8**th Amendment

Question #7: Literature

10 points per part

	The title object of this poem "intimately lives with rain".	
1	Name this object that finishes the line, "I think that I shall never see a poem lovely as" this object.	a **tree**(s)
2	This poet wrote "Trees" before dying in World War I.	(Alfred) Joyce **Kilmer**
3	According to the poem, the tree "lifts her leafy arms" to do what?	**pray**

Question #8: Literature

10 points per part

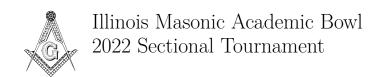|	This novel was originally typed onto a continuous reel of paper.	
1	Name this 1951 novel about Sal Paradise and Dean Moriarty traveling around the United States.	*On the Road*
2	This Beat author wrote *On the Road* and *The Dharma Bums*.	Jack **Kerouac** [**"CARE"-oo-ak**] [or Jean-Louis Lebris de **Kérouac**]
3	At the beginning of *On the Road*, Dean and Marylou arrive in New York from this city that Marylou returns to first. Sal later travels to this city, where he lives with Chad King and Roland Major.	**Denver**, Colorado

Question #9: Science

10 points per part

	These plants are similar to liverworts and hornworts.	
1	Name these bryophytes [BRY-oh-"fights"] that often form green clumps in shady areas. These plants grow on trees as epiphytes [EP-ih-"fights"].	**moss**es
2	Mosses reproduce using these objects similar to seeds. These objects are microscopic and start out under the moss leaves.	**spore**s
3	Some mosses decay into this material that can be used as soil and is often in bogs.	**peat**

Question #10: Science

10 points per part

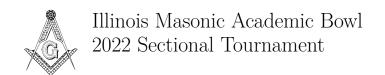|	Archaea [ar-KEE-uh] and bacteria are these types of organisms.	
1	Name these mostly unicellular [YOO-nih-"cellular"] organisms that do *not* have membrane-bound organelles.	**prokaryote**s ["**pro-carry-oat**s"]
2	Some prokaryotes and some eukaryotes have these appendages used for movement. These appendages are longer than cilia [SILL-ee-uh].	**flagella** [**fluh-JELL-uh**] or **flagellum**
3	These prokaryotes live under conditions that are not conducive for most life forms. Thermophiles are organisms of this type that live in particularly hot environments.	**extremophile**s ["**extreme-oh-file**s"]

Question #11: Social Studies

10 points per part

	This state is between Colorado and Missouri.	
1	Name this state whose most populous city is Wichita and whose capital is Topeka.	**Kansas**
2	This fort in Kansas was built in 1827. It now contains a maximum-security prison.	Fort **Leavenworth**
3	This cattle trail is named after the person of Scottish–Cherokee descent who started it with Black Beaver. In the 19th century, this trail was used to take cattle between Texas and places in Kansas such as Abilene [AB-ih-leen].	**Chisholm** Trail

Question #12: Social Studies

10 points per part

	The First Transcontinental Railroad was completed near the town of Promontory in this state.	
1	Name this U.S. state that contains Great Salt Lake.	**Utah**
2	This national park in Utah is near Moab and is named for the shape of its rock formations.	**Arches** National Park
3	This mountain range, in the north part of Utah, is part of the Rockies and includes Mount Nebo [NEE-boh] and the Timpanogos [tim-uh-NOE-gus] Cave National Monument.	**Wasatch** Range or **Wasatch** Mountains

Question #13: Fine Arts

10 points per part

	This 15-minute musical piece has been described as a "continuous crescendo".	
1	Name this 1928 composition that begins with snare drums and flutes playing parts that get passed around to the rest of the orchestra.	***Boléro***
2	This Frenchman wrote *Boléro*. He also wrote the ballet *Daphnis et Chloé*.	(Joseph-)Maurice **Ravel**
3	This Russian dancer and actress commissioned Maurice Ravel to write *Boléro*.	Ida (Lvovna) **Rubinstein**

Question #14: Fine Arts

10 points per part

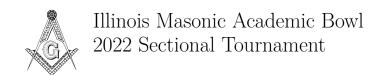|	This composer's sixth symphony is nicknamed "Tragic", and its fourth movement has a part for a hammer.	
1	Name this Austrian Romantic composer who also wrote *Das Lied [leet] von der Erde [ER-duh]*.	Gustav **Mahler**
2	Mahler's eighth symphony is given this nickname because it uses so many performers.	"Symphony **of a Thousand**" [or "Symphonie **von tausend**"]
3	This symphony by Mahler uses cowbells, a guitar, and a mandolin.	**seven**th symphony or "**Song of the Night**" [or "**Lied der Nacht**"]

Question #15: Literature

10 points

The female lead in this play states "If I be waspish, best beware my sting." When the male lead of this play later says "Sunday is the wedding-day", the female lead replies "I'll see thee hanged on Sunday first." The lead couple in this play does get married, but the man shows up late wearing inappropriate clothes, and during the ceremony he knocks over the priest. Near the end of this play, the husband wins a bet by demonstrating that he has the most obedient wife. Name this play about Petruchio [peh-TROO-kee-oh] and Katherina [kath-uh-REE-nuh], written by William Shakespeare.	*The **Taming of the Shrew***

Question #16: Science

10 points

Give either the common name or the scientific family name. The *Bothriomyrmex decapitans* ["both"-REE-oh-MEER-mekss dee-KAP-ih-tanz] species of this animal family gets its name from biting off the heads of the *Tapinoma [tap-ih-NOH-muh]* genus. The complex interactions used by these animals to support each other led to the development of sociobiology by E. O. Wilson, who was an expert on these animals. Like wasps and bees, these common animals belong to the order *Hymenoptera* ["hi-men"-AHP-teh-ruh] within the class Insecta, and they have drones and queens. These insects can be yellow or red but are usually brown or black. Name these very common insects, some types of which are called "carpenter" and "fire".	**ant**s [or **Formicidae**]

Question #17: Social Studies

10 points

This president's secretary of State wrote a letter to Austria saying "The house of Hapsburg are but as a patch on the earth's surface." Shortly after that, this president met with Lajos Kossuth [LAH-yosh KOH-shoot], the exiled leader of Hungary. This president's second secretary of State was Edward Everett, who replaced Daniel Webster. This person is the only president to both become president due to his predecessor's death and to fire his predecessor's entire cabinet. Just after this person became president, he supported and signed the Compromise of 1850. This person was the last president from the Whig Party. Name this person who became president when Zachary Taylor died.	Millard **Fillmore**

Question #18: Fine Arts

10 points

This painter used the phrase "sea of blood" to describe his painting of Napoleon's exile at St. Helena. This painter purposely contrasted that painting with a painting depicting his friend David Wilkie's burial at sea by naming one of them *War* and the other one *Peace*. Another painting by this artist is set on the Maidenhead Railway Bridge on a very cloudy day. A close look at that painting reveals a rabbit trying to escape from the oncoming train, which belongs to the Great Western Railway. Name this British artist of *Rain, Steam, and Speed*.	J(oseph) M(allord) W(illiam) **Turner**

Question #19: Literature

10 points

In this novel, a woman tells her husband "There is no lending in that house. There is only giving." Those words are spoken in this novel after the husband says he is lending silver to his uncle, and when the uncle tells people that the family is rich, their house gets robbed. The husband in this novel eventually gets wealthy enough to buy a concubine and a lot of land from the Hwang family, and by the end of this novel his wife O-Lan dies. The author of this book was born in West Virginia, but because her parents were missionaries, she spent a lot of time in China. Name this novel about Wang Lung that was written by Pearl S. Buck.	*The **Good Earth***

Question #20: Science

10 points

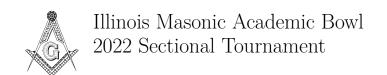|	
This element combines with sodium and aluminum to form cryolite ["CRY-oh-light"]. The 1906 Nobel Prize for Chemistry was given to Henri Moissan [awn-ree mwah-sawn] for isolating this element. The compound known as "hex" consists of six atoms of this element around uranium and is used in uranium enrichment. The acid formed by combining this element with hydrogen is harmful to glass containers and is sometimes used to etch glass. This element was combined with carbon, hydrogen, and chlorine to make Freon [FREE-ahn], which was used as a refrigerant until it was discovered to harm the ozone layer. Name this lightest halogen that has a very high electronegativity.	**fluorine** [accept **F**]

Question #21: Mathematics

10 points per part

	The mathematics describing these shapes was developed starting with a paper titled "How Long Is the Coast of Britain?".	
1	Name these shapes that exhibit self-similarity.	**fractal**s
2	The article was written by this mathematician, the namesake of a set generated by repeatedly squaring a complex number and adding a constant.	Benoît **Mandelbrot** [ben-wah **man-dul-brawt**]
3	The Cantor set has fractal properties and is generated by repeatedly removing the middle third from a set of numbers. Find the ratio of the remaining set to the original set after the middle third is removed twice.	**4/9**

Question #22: Mathematics

10 points per part

	Any three points determine a plane, unless the points have this property.	
1	Name this property that exists for points in a plane if the slopes between any pair of them are equal.	**co-linear**ity or being **co-linear** [prompt on answers referring to lying on a **line**]
2	A theorem named for this person states that extensions of opposite sides of a hexagon meet at collinear points if the hexagon vertices are on a conic section.	Blaise **Pascal** [accept **Pascal**'s theorem]
3	Find the y-coordinate of a point if its x-coordinate is 10 and the point is collinear with the point "zero comma 5" and the point "2 comma 9".	**25** [accept $(\mathbf{10, 25})$]

Question #23: Social Studies

10 points per part

	Walter Lippmann said of this U.S. president, "This active inactivity suits the mood and certain of the needs of the country admirably."	
1	Name this president who replaced Warren Harding and then won the election of 1924.	(John) Calvin **Coolidge** (Jr.)
2	This secretary of State under Coolidge won a Nobel Peace Prize for working with French foreign minister Aristide Briand [ah-ree-steed bree-awn] to create a treaty renouncing war as a national policy.	Frank B(illings) **Kellogg**
3	Coolidge supported this plan that worked out the terms of Germany's World War I reparations payments.	**Dawes** Plan

Question #24: Social Studies

10 points per part

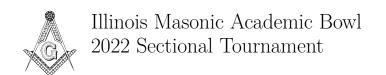|	This person was praised for his performance at the First Battle of Bull Run despite being on the losing side.	
1	Name this general who later burned Atlanta and led the March to the Sea.	William Tecumseh **Sherman**
2	William Sherman was a brigadier general under Ulysses Grant at this Union victory in Tennessee.	Battle of **Shiloh** [**SHY-loh**] [accept **Pittsburg Landing**]
3	This Confederate general died soon after being a pallbearer at Sherman's funeral. Along with P. G. T. Beauregard and Stonewall Jackson, this person led the Confederate Army at the First Battle of Bull Run.	**J**oseph E. **Johnston** [prompt on **Johnston**]

Question #25: Literature

10 points per part

	Answer the following about myths related to the first humans:	
1	According to Greek myth, this person was the first woman. She opened a jar that let evil into the world.	**Pandora**
2	According to the Popol Vuh, this civilization believed that there were failed attempts to make humans out of mud and then wood before humans were successfully made from corn.	**Maya**ns
3	According to the folklore of what is now this country, the first people were Malakas [mah-luh-KAHS] and Maganda [mah-gun-DAH], who were created when a bird split a bamboo pole.	(Republic of) the **Philippines** or (Republika ng) **Pilipinas**

Question #26: Literature

10 points per part

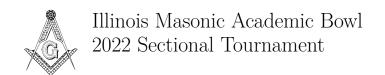|	All objects except for one plant made a vow not to harm this Norse god.	
1	Name this god who was killed when Loki gave a spear with that plant on it to the blind god Höd.	**Balder**
2	Name the plant that was used to kill Balder.	**mistletoe**
3	Hanging mistletoe was common during this Roman festival that took place in December. The Christmas tradition of kissing under the mistletoe is a remnant of either this festival or the Greek Kronia festival.	**Saturnalia**

Question #27: Science

10 points per part

	This diagram is a plot of luminosity versus temperature.	
1	Name this diagram used to classify stars.	**Hertzsprung–Russell** diagram [accept **H–R** diagram]
2	This two-word phrase can be used to label the *y*-axis of the Hertzsprung-Russell diagram rather than luminosity.	**absolute magnitude**s
3	Another famous diagram in astronomy is Edwin Hubble's galaxy sequence, which is nicknamed after this object due to its shape.	**tuning fork** [accept **tuning-fork** diagram; prompt on **fork**]

Question #28: Science

10 points per part

	Name these stars:	
1	This star, sometimes called "Alpha Ursa Minor", has been used for navigation for hundreds of years. It can be located by following a line made by the end of the bowl in the Big Dipper.	**Polaris** [accept the **North Star** or the **Pole Star**]
2	This star is traditionally called "Alpha Orion" even though Rigel ["RYE"-jul] is brighter.	**Betelgeuse** ["beetle-juice"]
3	In 1850, this star became the first one other than the Sun to be photographed. It joins Altair and Deneb [DEN-eb] to form the Summer Triangle.	**Vega** [or **Alpha Lyra**]

Question #29: Social Studies

10 points

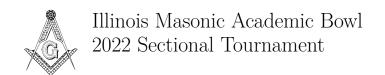|	
This country's 1963 revolution is sometimes called the Ramadan Revolution and was followed by Ali Salih al-Sa'di's National Guard killing suspected dissidents. This country was established as a republic after the July 14 Revolution in 1958, which led to the deaths of Prime Minister Nuri al-Said [sah-EED] and King Faisal [FY-sahl] II. During the 1980s, this country fought a brutal war with Iran that ended in a stalemate and during which this country used chemical weapons against Iran and some of its own people. In 1990, this country annexed Kuwait, provoking a U.S. invasion. Name this country that was led by Saddam Hussein until the U.S. deposed Hussein in 2003.	(Republic of) **Iraq** [or Jumhuriyat al-**Iraq**]

Question #30: Mathematics

10 points

An algorithm for finding approximate values of this function uses three digits at a time and looks like long division. Applying this function to the number 2 gives the Delian [DEE-lee-un] constant, and the Delian problem attempted by ancient mathematicians was eventually proven impossible because applying this function to 2 gives a non-constructible number. When this function is applied to a complex number, the three results are 120 degrees apart from each other on an Argand diagram. Name this function that is the inverse function of raising to the third power.	**cube**d **root** or raising to the **1/3 power** or raising **to the 1/3** power [do not accept or prompt on "(square) root" or "radical"]

Question #31: Literature

10 points

In one novel by this author, Moose Malloy kills a nightclub owner, but the police do not track him down because the murdered man was African-American. This author then describes his protagonist's efforts to find Malloy's ex-girlfriend Velma Valento. In another novel by this author, Carmen asks the protagonist for shooting lessons, but he tricks her by putting blanks in her gun. This author set part of that novel at Geiger's bookstore in Los Angeles. Name this detective fiction writer who wrote *Farewell, My Lovely* and *The Big Sleep*, both of which feature Philip Marlowe.	Raymond (Thornton) **Chandler**

Question #32: Science

10 points

Power plants that collect this type of energy are classified as binary cycle, flash cycle, or dry steam. This renewable energy source is more constant than other sources, though its initial costs have prevented it from becoming more widespread. The best places for power plants that collect this energy are along the Ring of Fire and where the Earth's crust is thin. The primary source of this energy is the natural radioactive decay of potassium, thorium, and uranium, and that energy is often collected by heating water. Ground-source heat pumps collect this type of energy. Name this type of heat energy collected from the Earth.	**geothermal** energy [prompt on **thermal** energy]

Extra Question #1: Mathematics

10 points

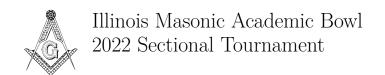|	
The fractal named for Helge von Koch [hell-guh vohn "coke"] is built by starting with this shape and repeatedly adding these shapes to the middle of the sides. The Sierpiński [sir-PIN-skee] sieve is a fractal built by starting with this shape and repeatedly removing these shapes from the middle. The area of this shape can be found by multiplying 1/2 times the magnitude of a cross product if two of its sides are treated as vectors. The "ambiguous case" is a situation in which there are two possible versions of this shape. Methods to prove that two of these shapes are congruent to each other include "side-side-side" and "side-angle-side". Name this shape with three sides.	**triangle** [before "ambiguous case", accept equilateral **triangle**s or equiangular **triangle**s or regular **triangle**s]

Extra Question #2: Social Studies

10 points

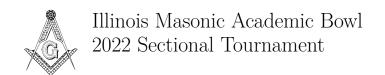|	
This U.S. president tried to encourage people to save more money by promoting buttons that said "W.I.N.", which stood for "Whip Inflation Now." There were two assassination attempts against this president, by Sara Jane Moore and by Charles Manson follower "Squeaky" Fromme. When this person became president, he stated "Our long national nightmare is over." This person is the only person to serve as both vice president and president without being elected to either job; he replaced Spiro Agnew as vice president. This person lost the election of 1976 to Jimmy Carter. Name this president who pardoned Richard Nixon after succeeding him.	Gerald R(udolph) **Ford** (Jr.) [or Leslie Lynch **King** Jr.]

Extra Question #3: Science

10 points

This moon has insulae [IN-suh-lee], which are features that appear to be islands. This moon also has flumina [FLOOM-in-uh], which are channels that could be rivers and that have been named after mythical rivers. This moon is the only one in our Solar System with a thicker atmosphere than Earth, and its atmosphere is mostly nitrogen. This moon is in orbital resonance with Hyperion ["hi"-PEER-ee-ahn]. This moon has over three times the diameter of Rhea [RAY-uh] and Iapetus ["eye"-AP-eh-tuss], which are the next-largest moons orbiting the same planet. This moon is the second-largest moon in our Solar System, after Ganymede [GAN-ih-meed]. Name this moon that orbits Saturn.	**Titan**

Extra Question #4: Literature

10 points

A very bright object of this type is carried by Surtr [SURT-ur], who destroys the Earth during Ragnarök [RAG-nuh-"rock"]. Freyr had an object of this type that was able to perform without human assistance, but he lent it to Skírnir and had to use an antler instead of this object at Ragnarök, which benefitted Surtr. Peter Pevensie used an object of this type named Rhindon when he led a revolutionary army in *The Chronicles of Narnia*. Unferth owned one of these objects that was always successful and which he loaned to Beowulf; that object was Hrunting [RUN-teeng]. Identify these objects such as King Arthur's Excalibur.	**sword**s [prompt on **blade**s or **weapon**s]

Extra Question #5: Fine Arts

10 points

In the middle of the last act of an opera by this composer, Wolfram sings "O thou my fair evening star." At the end of that opera, this composer portrayed the death of the title character after he sees the dead body of Princess Elisabeth. Another opera by this composer ends with a character freeing ravens and riding her horse into a fire. That Immolation Scene shows the death of Brünnhilde [broon-HEEL-duh] at the end of *Götterdämmerung* [GUH-tur-DAH-mer-oonk]. A related opera by this composer begins with the "Ride of the Valkyries". Name this composer of *Tannhäuser* [TAHN-hoy-zur] and a series of four operas called the *Ring* Cycle.	Richard **Wagner** [reek-hart **VAHG-nur**]

Extra Question #6: Literature

10 points per part

	This character asks "What is the use of a book without pictures or conversations?".	
1	Name this girl who falls down a hole and finds a little bottle with a label saying "Drink me". She drinks from the bottle because it is not labeled "Poison".	**Alice**
2	Give the pen name used by Charles Dodgson when he wrote *Alice's Adventures in Wonderland.*	Lewis **Carroll**
3	The Queen of Hearts asks Alice if she has seen this animal, but Alice responds that she does not know what this animal is. This creature and the Gryphon dance to the Lobster Quadrille.	**Mock Turtle** [prompt on **turtle**]

Extra Question #7: Literature

10 points per part

	At the end of this book, Wart learns his real name.	
1	Name this book that is the first in a series, preceding *The Queen of Air and Darkness.*	*The **Sword in the Stone***
2	This 20th-century author wrote about King Arthur in the series collectively called *The Once and Future King.*	T(erence) H(anbury) ("Tim") **White**
3	Before learning that he is King Arthur in *The Sword in the Stone*, Wart is tutored by this wizard who sometimes turns him into an animal.	**Merlin**

Extra Question #8: Mathematics

10 points per part

	These diagrams are similar to Euler [OY-lur] diagrams.	
1	Name these diagrams that typically use overlapping circles to represent sets.	**Venn** diagrams
2	How many regions does a Venn diagram have if there are two sets? Include the region that is outside both sets.	**four** regions
3	If there are two sets, one of which has 12 elements and another of which has 20 elements, and their union has 25 elements, then how many elements are in their intersection?	**seven** elements

Extra Question #9: Mathematics

10 points per part

	This shape is used to approximate integrals by approximating a function's graph as a series of line segments.	
1	Name these quadrilaterals that have *one* pair of opposite parallel sides.	**trapezoid**s [accept **trapezium**s]
2	Find the area of a trapezoid if its bases measure 5 units and 7 units and the height is 3 units.	**18** square units
3	If one of the bases of a trapezoid makes a 75-degree angle with a side, find the measure, in degrees, of the angle between the other base with the same side.	**105** degrees