

Section A. Each correct answer is worth 1 point.

- List all the prime numbers between 20 and 30.
- Perimeter is to square as \_\_\_\_\_ is to circle.
- Find the sum:  $1 + 1 + 2 + 6 + 11 + 20 + 37 + 68 + (-58) + (-27) + (-10) + (-1)$
- Which of the following capital letters appear to have a horizontal line of symmetry?  
**A B C D E F G H I J K L M N O P**
- If a Sunday falls on the 24th of the month, what is the probability that the *next* Sunday will fall on the 31st of that month? Express your answer as a fraction or ratio in simplest form.
- Darryl scored 36 points. Steve scored 12 points more than did Don, who had  $\frac{1}{4}$  as many points as did Darryl. How many total points did all three players score?
- Evaluate:  $2009^1 + 2009^0 - \frac{30}{1/3}$ .

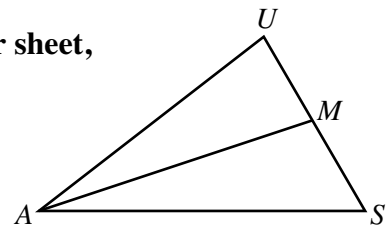
Section B. Each correct answer is worth 2 points.

- Find the *slope* of the line  $2x + y - \frac{3}{4} = \frac{4}{3}$ .
- Shown below are the *first two steps* in a proof. **On your answer sheet,** fill in the missing statement for step 2.

*Given:*  $\triangle USA$  with  $M$  the midpoint of  $\overline{US}$ .

*Prove:* Area of  $\triangle MAU =$  Area of  $\triangle MAS$ .

Statements	Reasons
1. $M$ is midpoint of $\overline{US}$	1. Given
2. _____	2. Definition of midpoint



- How many of the integers  $x$ ,  $1 \leq x \leq 500$ , do *not* contain the digit “3”?
- Express in simplest radical form (no radicals in the denominator):  $\frac{3\sqrt{2}}{2\sqrt{3}}$
- Find the *remainder* when  $(2x^2 - 2x + 25)$  is divided by  $(x - 5)$ .

Section C. Each correct answer is worth 3 points.

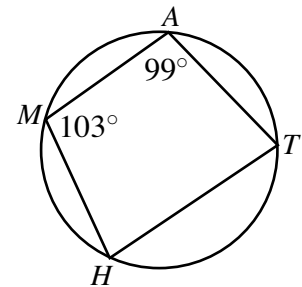
- Let  $P$  be the *product* of a collection of two or more positive integers (repeats allowed) which have a *sum* of 13. Find the largest possible value of  $P$ .
- Given:  $\log_b a + \log_b c = b$ . Solve for  $c$  in terms of  $a$  and  $b$  without “log” in the answer.
- Find the vertex of the parabola  $4x^2 + 12x + 2y = -7$ . Express as an ordered pair  $(x, y)$ .

Section A. Each correct answer is worth 1 point.

1. Latin teacher Mathematicus had 1 penny, 5 nickels, 10 dimes, 25 quarters, 50 50-cent pieces, and 100 dollar bills. How much money did he have in all?
2. Find  $2009\sqrt{2009}$  to the nearest *hundredth*.
3. The greatest common factor of  $x$  and  $y$  is 3, and their lowest common multiple is 66.  $x$  is 33. Find the value of  $y$ .
4. Express as an improper fraction in simplest form:  $\frac{2}{5} + 1.\bar{3}$ .
5. The numbers 1, 3, 6, 10, 15, 21, ... are known as triangular numbers. What is the largest triangular number *less than 300*?
6. Find the area of a rectangle if its length is 24 and its diagonal has length 25.
7. Among the adult residents of Mathville, half of the men are married to women, and  $\frac{1}{3}$  of the women are married to men. (No one is married to more than one person.) If there are 240 men in the village, how many total adults live in Mathville?

Section B. Each problem is worth 2 points.

8. Quadrilateral *MATH* is inscribed in the circle as shown. Name the smallest angle in the quadrilateral and give its measure.
9. I bought 3 books at \$19.90 each. My total cost, including sales tax, was \$63.58. What was the sales tax rate (to the nearest half of one percent)?
10. Let  $z = |-x| - |2y| + xy$ . Evaluate  $z$  if  
(a)  $x = 3$  and  $y = -2$ . (b)  $x = -3$  and  $y = -4$ . (For credit, both answers must be correct.)
11. Larry, Curly, and Moe divide a pile of  $n$  pennies like so: If  $n$  is **even**, Larry takes half the pile. If  $n$  is **odd**, Moe takes one, then Curly takes half of those that remain. This process is repeated until the pile is gone. If the original pile contains 2009 pennies, how many will *Curly* get?
12. The base of an isosceles triangle is 25 cm long, and the vertex angle measures  $40^\circ$ . Find the length (in cm) of a leg. (If appropriate, round to two decimal places.)



Section C. Each problem is worth 3 points.

13. Find all solutions (both real and complex) to  $x^5 - 14x^3 - 72x = 0$ . Express your answers either exactly or rounded to two decimal places.
14. The length of each side of an isosceles triangle is an integer. The legs have length  $x + 1$ , and the base length is  $3x - 2$ . Determine all possible values for this triangle's *perimeter*.
15. Evaluate:  $\sum_{k=1}^6 [k^2 + (k - 1)!]$ .

**PART I**

Section A

1. 23, 29
2. circumference
3. 50
4. B C D E H I K O
5.  $\frac{7}{12}$
6. 66 points
7. 1920

Section B

8. slope =  $-2$
9.  $SM = MU$  or  $\overline{SM} \cong \overline{MU}$
10. 324
11.  $\frac{\sqrt{6}}{2}$  or  $\frac{\sqrt{2}\sqrt{3}}{2}$
12. 65

Section C

13. 108
14.  $c = b^b/a$
15.  $(-1.5, 1)$  or  $(-\frac{3}{2}, 1)$

**PART II**

Section A

1. \$132.51
2. 90,047.14
3.  $y = 6$
4.  $\frac{26}{15}$
5. 276
6. 168 square units
7. 600 adults

Section B

8.  $m\angle T = 77^\circ$
9. 6.5%
10. (a)  $z = -7$       (b)  $z = 7$
11. 1217 pennies
12. 36.55 cm

Section C

13.  $\{0, \pm 2i, \pm 3\sqrt{2} \text{ [or } \pm 4.24]\}$
14. 5, 10, 15
15. 245