2017 John O'Bryan Mathematical Competition
Freshman-Sophomore Individual Test

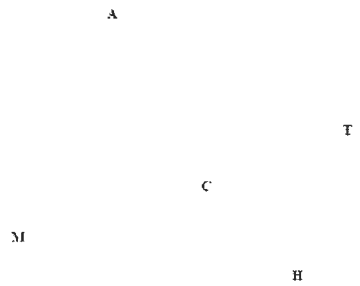
Directions: Please answer all questions on the answer sheet provided. All

2. The points $(7,a)$ and $(b,6)$ lie on a line with the equation $x-3y+25=0$. Find $3a+b$

3. Let A be a positive two-digit integer. The integer B is the same as A when its digits are reversed. What is the largest value of A such that $A=3B-2$?

4. The ratio of two supplementary angles is 1:8. Find the degree measure of the smaller of the two angles.

5. In the diagram at the right, $\overline{MA} \parallel \overline{TH}$, $MA = 4x$, $AC = 5x+2$, $MC = 3x+4$, $CT = x+3$ and $TH = x+2$. Find the length of $\overline{CH}$.

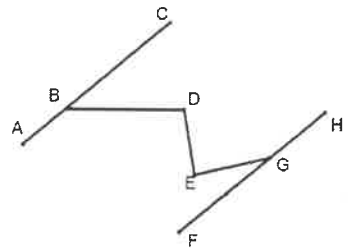


6. $\overline{AB}$ is a chord in circle O such that the degree measure of minor arc $\overset{\frown}{AB}$ is one-quarter the degree measure of major arc $\overset{\frown}{AB}$. Find the degree measure of $\angle OAB$.

7. The average of three values is $3x+2y$. If two of the values are $4x+2y$ and $3x-y$, find the third value. Give your answer as an expression in terms of x and/or y.

8. When eight coins are flipped, find the probability that tails occurs exactly three times. Write your answer as

13. The sum of the smallest and largest of three consecutive even integers is 52. The integer k is 10 less than the median of the three consecutive even integers. If $p^2 = k$ where p is a positive integer, find the value of p.

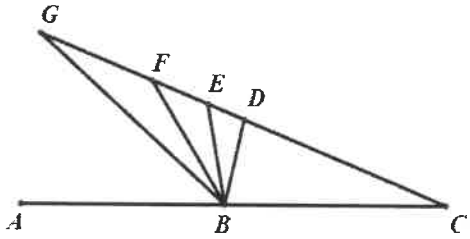


14. In the diagram to the right, $\overline{AC} \parallel \overline{HF}$, $\angle CBD \cong \angle GED$, the measure of $\angle E$ is 18° less than $\angle D$, and the measure of $\angle FGE$ is 44°. Find the degree measure of $\angle D$.

15. A circle with area 81π is inscribed in an equilateral triangle. Find the area of the triangle, rounding your answer to the nearest integer.

16. If $3x^2 + 8 = 56$, find the smallest possible value of $4x - 5$.

17. If $\begin{bmatrix} 3 & 2 \\ d & 4 \end{bmatrix} + 2\begin{bmatrix} 4 & 3 \\ e & 5 \end{bmatrix} = \begin{bmatrix} a & b \\ 4 & c \end{bmatrix}$, find the value of the expression $(a + b + c + 2d + 4e)$.



18. In the diagram at the right, the measure of $\angle CBF$ is 73° more than the measure of $\angle ABG$. $\overline{BD}$ bisects $\angle CBG$ and $\overline{BE}$ and $\overline{BF}$ trisect $\angle DBG$. Find the degree measure of $\angle EBC$.

19. One of the following statements is selected at random. Find the [redacted] parallelograms. Write your answer as a common fraction reduced to lowest terms.

Name: ANSWERS Team Code:

2017 John O'Bryan Mathematical Competition

1.		11.	
2.	5	12.	5
3.	82	13.	4
4.	20	14.	80
5.	6	15.	421
6.	54	16.	–21
7.	$2x + 5y$ OR $5y + 2x$	17.	41
8.		18.	92 Degrees Optional
9.	16	19.	1/2
10.	4	20.	Thursday Must be this entire word.

Awards Lists and Solutions to the Team Competition may be found at http://math.nku.edu/job