

Please use a **black or blue pen** and write legibly.

Name: _____ School: _____ Grade: _____

- Please write your final answers in the boxes on the right. Problems are weighted equally.
- You do not need to show your work, and there is no penalty for guessing.
- This sheet will be scanned. Please use a **black or blue pen** and write legibly.
- No aids are permitted other than blank paper, graph paper, ruler, compass and protractor.
- **You may not use a calculator nor any electronics. You have 60 minutes for 12 problems.**

1.	The hypotenuse of a right triangle is 39, and the ratio of its legs is 5:12. What is its area?	270
2.	In rectangle $ARML$, point D is the midpoint of ML and points E and F lie on AL and AR , respectively such that $\frac{AE}{EL} = \frac{3}{2}$ and $\frac{AF}{FR} = 2$. Given $AR = 36$ and $AL = 25$ compute the area of pentagon $RMDEF$.	630
3.	Quadrilateral $ARML$ is a kite with $AR = RM = 5$, $AM = 8$, and $RL = 11$. Compute AL .	$4\sqrt{5}$
4.	For how many positive integers y does there exist a positive integer x such that $x^2 - y^2 = 72$?	3
5.	A bus holds up to 45 people. It doesn't have to be full. Adults pay \$8, and children pay \$5. If the total paid by all riders is exactly \$250, what is the maximum possible number of children on the bus?	34
6.	Find the ordered pair (a, b) of positive integers with $a < b$ such that $a^2 + b^2 + a^2b^2 = 2004$.	$(2, 20)$
		Turn over!

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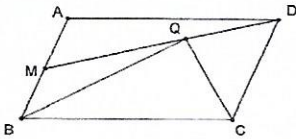
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7.	<p>What is the smallest positive solution (in radians) of the following equation?</p> $5 \cos x + 2 \sin^2 x = 4.$	$\frac{\pi}{3}$
8.	<p>A sphere sits in a corner of a rectangular room, touching two adjacent walls and the floor. A point on the sphere is 5 units from each of the walls that it touches and 10 units from the floor. List all possible values of the radius of the sphere.</p>	<p>5 or 15</p>
9.	<p>The <i>reduced</i> fraction $\frac{a}{b}$ is equal to 0.57171717... Give the value of $a + b$.</p>	<p>778</p>
10.	<p>Compute the sum of the roots of the equation:</p> $ x - 3 - 5 = 3.$	<p>12</p>
11.	<p>Through which quadrants does the circle $x^2 + 4x + y^2 - 6y + 1 = 0$ pass?</p>	<p>I, II, III</p>
12.	<p>Nine fair coins are independently flipped. Compute the probability that an odd number of them come up heads. Express your answer as a fraction in simplest form.</p>	$\frac{1}{2}$ <p>Turn Over!</p>

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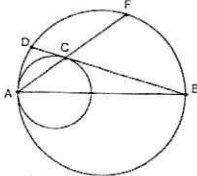
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13	<p>In parallelogram ABCD, $CD = 12$, $AM = 6$, and $\triangle QMB$ and $\triangle DQC$ each have area 60. Compute the area of $\triangle QBC$.</p> 	150
14	<p>What real value for b solve the equation</p> $\frac{\log_{b-1}(b)}{\log_{b+1}(b)} = 2?$	3
15	<p>If the points $(4, b)$, $(b, 2b - 8)$ and $(-4, 8)$ are collinear, compute all possible values of b</p>	8, 12
16	<p>The imaginary number $z = 3 - 2i$ is drawn in the complex plane. The vector z is rotated 90° counterclockwise about the origin and the resulting vector is then reflected across the y-axis. What complex number is represented by this final vector?</p>	$-2 + 3i$ or $(-2, 3)$
17.	<p>Sally runs one mile at 6 miles per hour and then the next mile at 8 miles per hour. What is her average speed in miles per hour for the 2-mile run?</p>	$\frac{48}{7}$
18.	<p>If $2^x = 8^{y+1}$ and $9^y = 3^{x-9}$, find the value of $x + y$</p>	27

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19	If $0 < A < 90^\circ$ and $2 \cos A = \sqrt{3} \cos 23^\circ - \sin 23^\circ$, compute A	53
20	What is the ratio of the volume of a cube circumscribed about a sphere to the volume of a cube inscribed inside the same sphere?	$3\sqrt{3}$
21.	Two circles are internally tangent at point A ; diameter \overline{AB} of the larger circle passes through the center of the smaller circle. Chord \overline{BD} of the larger circle is tangent to the smaller circle at C ; \overline{AC} intersects the larger circle at F . If the measure of arc $\widehat{FB} = 82^\circ$, compute the measure of arc \widehat{AD} .	16° 
22.	An integer is divided by 3, 4, 5, and 6, giving remainders 2, 3, 4, and 5, respectively. What are all the possible remainders when this integer is divided by 240? (Note: your answer(s) should be in the interval $[0, 240)$, and can be given in any order.)	59, 119, 179, 239
23	How many of the coefficients in the expansion of $(x + y)^{64}$ are even numbers?	63
24	What is the largest power of 42 which divides into $2006!$ evenly?	331 Turn over!