Date Completed: _____
Mentor Initials: _____

A mentor can change everything.

ESM PREP

# "Advanced" Problems Part Two

*Please take under timed pressure:* ***30 minutes.***

This quiz is comprised of questions you will encounter in the final 10-15 questions of the ACT Math test. As you complete each question, please consider if, on an actual test, you would:

- **ATTACK** the question: you can answer it quickly and accurately, possibly using a strategy or a formula from the ACT Math Formula Sheet.
- **SKIP** the question: you don't know how to answer it quickly and do not have a strategy or formula to use *(Remember: try to eliminate as many answers as possible before guessing).*

**1.** A sporting-goods store sells basketballs for \$27 each. At this price, 30 balls are sold per week. For every \$1 decrease in price, the store will sell 3 more balls per week. The store will adjust the price to maximize revenue. Which of the following values is closest to the maximum possible revenue for 1 week?
(Note: Revenue is equal to the product of the number of items sold and the average price of the items.)

**A.** \$810
**B.** \$900
**C.** \$966
**D.** \$1,026
**E.** \$1,032

**2.** Which of the following values is the $x$-coordinate of the point in the standard $(x, y)$ coordinate plane where the graph of the line $y = 5$ intersects the graph of the function $f(x) = \ln(x + 4) - 3$?
**A.** 4
**B.** $e^3 - 4$
**C.** $e^8 - 4$
**D.** $\ln(9) - 3$
**E.** $\ln(4) - 8$

**3.** Katie is going to choose her own ten-digit phone number. The first three digits will be her 415 area code. The fourth digit must be a multiple of three. The fifth and tenth digits must be even. The seventh digit cannot be zero. There are no restrictions on the remaining digits. How many possible phone numbers does Katie have to choose from?

(Note: Zero is a multiple of all numbers and is also even.)

**A.** 630,000
**B.** 720,000
**C.** 810,000
**D.** 900,000
**E.** 990,000

**4.** The lengths of two sides of a triangle are 4 inches and 7 inches, respectively. What is the range of all possible values for $x$, the length of the third side of the triangle?
**A.** $2 < x < 10$
**B.** $3 < x < 10$
**C.** $3 < x < 11$
**D.** $4 < x < 7$
**E.** $4 < x < 11$

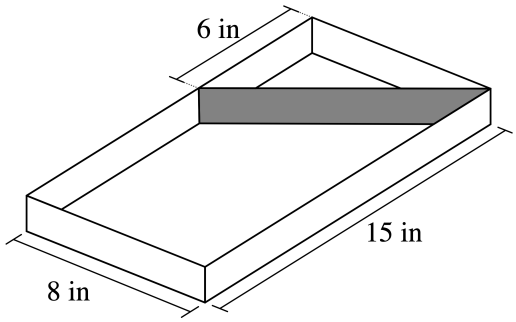
**5.** The greatest common factor of two whole numbers is 12. The least common multiple of these same two numbers is 144. What are the two numbers?
**A.** 12 and 72
**B.** 24 and 36
**C.** 36 and 48
**D.** 48 and 60
**E.** 48 and 72

**6.** Susie has taken five tests in Algebra II and has an 88% test average. What is the minimum average that she must achieve on her final two tests in order to secure a 90% test average in the class, if all tests are weighted equally and there is no rounding of grades?
**A.** 93%
**B.** 94%
**C.** 95%
**D.** 96%
**E.** 97%

**7.** At the school carnival, Jim will play a game in which he will roll two 6-sided dice. If a die lands on an odd number, Jim will be awarded the equivalent number of points. For example, if he rolls a 3, he receives 3 points. If a die lands on an even number, Jim will get twice that number of points. For example, if he rolls a 4, he receives 8 points. What is the expected value of Jim's point total after rolling both dice once?

**A.** 8
**B.** 9
**C.** 11
**D.** 12
**E.** 13

**8.** The rectangular container shown below has a small compartment for water created by a rectangular dividing wall of negligible width. One face of the dividing wall, shaded below, has an area of 40 square inches. What is the volume, in cubic inches, of the larger compartment?




**A.** 96
**B.** 324
**C.** 384
**D.** 420
**E.** 480

**9.** For real numbers $x, y,$ and $z$ such that $x > y > z$ and $y < 0$ and $|x| < |y|$, which of the statements below must be true?

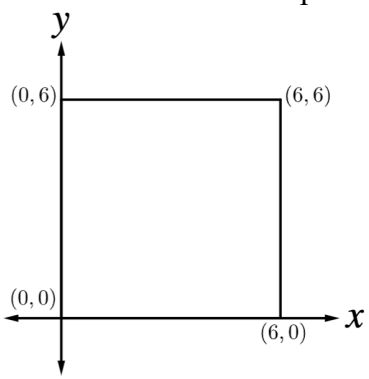
I. $|x| < |z|$
II. $|y + z| > |x|$
III. $|y - z| > |x|$

**A.** I only
**B.** II only
**C.** III only
**D.** I and II only
**E.** I and III only

**10.** Solution A is 5% salt. Solution B is 30% salt. How many liters of each must be combined to make 20 liters of a 25% solution?

**A.** 4 liters of A and 16 liters of B
**B.** 5 liters of A and 15 liters of B
**C.** 8 liters of A and 12 liters of B
**D.** 15 liters of A and 5 liters of B
**E.** 16 liters of A and 4 liters of B

**11.** A rectangle, with its vertex coordinates labeled, is graphed in the standard $(x, y)$ coordinate plane below. A lattice point is a point with coordinates that are both integers. A lattice point inside but NOT on the rectangle will be chosen at random. What is the probability that the sum of the $x$-coordinate and the $y$-coordinate of the chosen lattice point will be even?

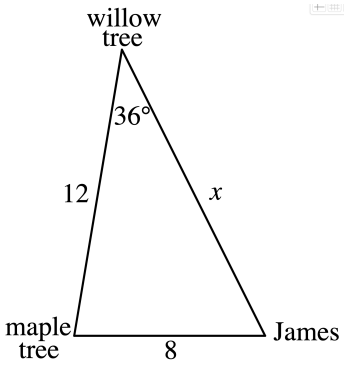



**A.** $\frac{2}{5}$
**B.** $\frac{12}{25}$
**C.** $\frac{1}{2}$
**D.** $\frac{13}{25}$
**E.** $\frac{3}{5}$

**12.** Cynthia and Tom are running laps. It takes Cynthia 18 seconds to run one lap. Tom takes 24 seconds to run one lap. How many laps will Cynthia have run when she will be exactly one lap ahead of Tim?

**A.** 2.5 laps
**B.** 3 laps
**C.** 3.5 laps
**D.** 4 laps
**E.** 4.5 laps

**13.** James is standing 8 meters from a maple tree that is 12 meters from a willow tree, as shown in the figure below, in which the measure of an angle is given. Which of the following equations, when solved for $x$, gives the distance, $x$ meters, between James and the willow tree?




**A.** $8^2 = x^2 + 12^2 - 2x(12)(\cos 36°)$

**B.** $8^2 = x^2 + 12^2 - 2(8)(12)(\cos 36°)$

**C.** $12^2 = x^2 + 8^2 - 2x(12)(\cos 36°)$

**D.** $x^2 = 8^2 + 12^2 - 2x(12)(\cos 36°)$

**E.** $x^2 = 8^2 + 12^2 - 2(8)(12)(\cos 36°)$

**14.** Six golfers will be randomly split into three groups of two players each for a tournament. If Jack and Kendall are among the six, what is the probability that they will be paired together?

**A.** $\frac{1}{6}$

**B.** $\frac{1}{5}$

**C.** $\frac{1}{4}$

**D.** $\frac{1}{3}$

**E.** $\frac{2}{5}$

**15.** If the $5^{th}$ term of an arithmetic sequence is 12 and the $9^{th}$ term is 28, what is the sum of the first 10 terms?

**A.** 110

**B.** 120

**C.** 130

**D.** 140

**E.** 150

**16.** For all positive values of $x$, which of the following expressions is equivalent to $\sqrt[3]{x^4}\left(\sqrt[6]{x^5}\right)$?

**A.** $x^{\frac{9}{10}}$
**B.** $x$
**C.** $x^{\frac{3}{2}}$
**D.** $x^2$
**E.** $x^{\frac{13}{6}}$

**17.** For all positive values of $x$ and $y$, which of the following expressions is equal to $\frac{x}{2y} + \frac{y}{3x}$ ?

**A.** $\frac{x+y}{2y+3x}$
**B.** 1
**C.** $\frac{3x^2+2y^2}{6xy}$
**D.** $\frac{x+2}{6xy}$
**E.** $\frac{1}{2y+3x}$

**18.** If the ratio of $x$ to $y$ is 4 to 1, and the ratio of $y$ to $z$ is 6 to 1, what is the value of $\frac{3x+2y}{3y+4z}$?

**A.** $\frac{7}{11}$
**B.** $\frac{3}{2}$
**C.** $\frac{5}{3}$
**D.** $\frac{29}{12}$
**E.** $\frac{42}{11}$

**19.** Timmy has \$4.00 in nickels, dimes, and quarters. He has twice as many dimes as quarters. He has three more nickels than dimes. How many nickels does Timmy have?

**A.** 13
**B.** 15
**C.** 16
**D.** 17
**E.** 20

**20.** Billy and Angelina moved to Vegas at the same time several years ago and have lived there ever since. Billy has lived there for $\frac{1}{3}$ of his life, while Angelina has lived there for $\frac{4}{5}$ of her life. If $B$ represents Billy's present age, which of the following expressions represents Angelina's present age?

**A.** $\frac{B}{10}$

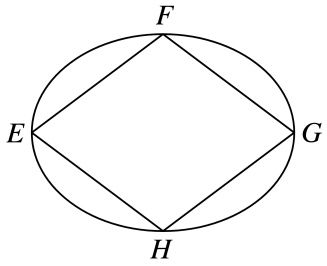
**B.** $\frac{3B}{10}$

**C.** $\frac{5B}{12}$

**D.** $\frac{2B}{3}$

**E.** $\frac{3B}{4}$

**21.** Shown below is quadrilateral $EFGH$ inscribed in an ellipse. The figure will be placed in the standard $(x, y)$ coordinate plane, and the ellipse will be described by the equation $\frac{x^2}{16} + \frac{(y-3)^2}{9} = 1$. Given that $EG$ is the major axis and $FH$ is the minor axis of the ellipse, what are the coordinates of Points $E$ and $F$?




| | Point $E$ | Point $F$ |
|---|---|---|
| **A.** | $(-2,3)$ | $(0,3)$ |
| **B.** | $(-4,3)$ | $(0,6)$ |
| **C.** | $(-3,3)$ | $(3,6)$ |
| **D.** | $(-4,3)$ | $(0,3)$ |
| **E.** | $(\ 0,3)$ | $(3,6)$ |

**22.** Adam wants to find the volume of a solid Baby Yoda figurine. He fills a rectangular container 9 inches long, 5 inches wide, and 11 inches high with water to a depth of 3 inches. The height of the water with the submerged Baby Yoda is 5.5 inches. What of the following is closest to the volume, in cubic inches, of the Baby Yoda figurine?

**A.** 113
**B.** 135
**C.** 175
**D.** 202
**E.** 248