# Dual Dig Level I (2007)

1. Simplify: $\left(\dfrac{1}{81}\right)^{-3/4}$

2. Find the value of x if $4^{20} + 4^{20} = 2^x$.

3. The square shown below can be filled in so that each row and each column contains each of the numbers 1, 2, 3, and 4 exactly once. What does x equal?

4			
		3	
	x		
1			4

4. At a party at which fewer than two-dozen people showed up, two-thirds of the men were married to three-fifths of the women. Assuming all spouses were present, how many people were single?

5. Let Ω be a new type of operation where: $a \; \Omega \; b = (a-b)^2 + b$ for any real a and b. Find $(3\,\Omega\,2)\,\Omega\,5$.

6. Find the length of $\overline{AB}$ in the figure below.
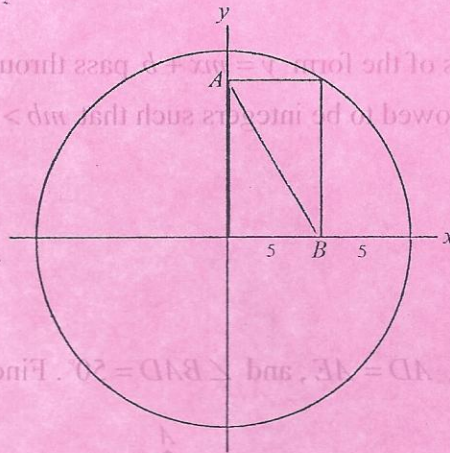
7. Harry Clotter takes the SAT three times. Harry's second score is 20% lower than his first score. Harry takes Pigwart's test prep program, and his third score is 2000 points, which is 25% higher than his second score. What was Harry's first score?

8. Simplify: $\sqrt[3]{\dfrac{125^N \cdot 5^{4N}}{25^{-N}}}$

9. Find the number of distinct (i.e., different) points at which the graphs of $x^2 + y^2 = 16$ and $x^2 = 16$ intersect in the standard xy-plane.

10. Simplify: $\dfrac{a^{-2}+b^{-1}}{a^{-1}+b^{-1}}$

11. A deck of cards consists of 13 hearts, 13 diamonds, 13 clubs, and 13 spades. (Assume there are no jokers or other extra cards.) At least how many cards must be drawn from the deck in order to be guaranteed that at least one of the drawn cards is a diamond?

12. Two cars left an intersection at the same time, one heading due north, and the other due west. Some time later, they were exactly 100 miles apart. The car headed north had gone 20 miles farther than the car headed west. How far had each car traveled?

13. In the rectangle $OABC$ below, side $\overline{OC}$ has length 3. Angles AOB, BOP, and POC each have measure $30°$. What is the perimeter of triangle BOP?
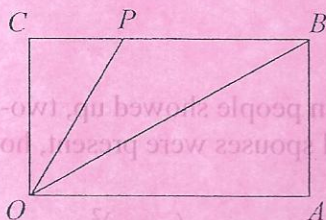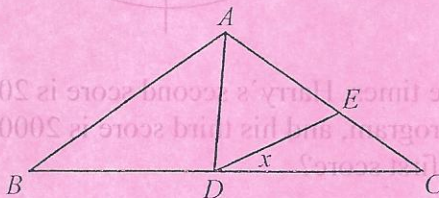

14. Simplify: $\dfrac{1}{\log_4 6}+\dfrac{1}{\log_9 6}$

15. How many lines with equations of the form $y = mx + b$ pass through the point $(3, 0)$ in the usual xy-plane if m and b are only allowed to be integers such that $mb > 0$?

16. Simplify: $\sqrt{0.0007}\sqrt{70,000}$

17. 3^{23} ends in what digit?

18. In the figure below, $AB = AC$, $AD = AE$, and $\angle BAD = 50°$. Find x.

19. Two bathtubs with equal amounts of water begin to be drained at exactly noon today. For each tub, the drainage rate stays constant over time until the tub is emptied, although one tub is drained faster than the other tub. The first tub becomes completely drained at exactly 12:04pm today, while the second tub becomes completely drained at exactly 12:12pm today. In how many minutes after noon does the first tub hold exactly half the amount of water that the second tub holds? Give your answer as an exact fraction or mixed number.

20. What is the largest number of pieces into which a circular pie can be cut with 10 straight cuts?