

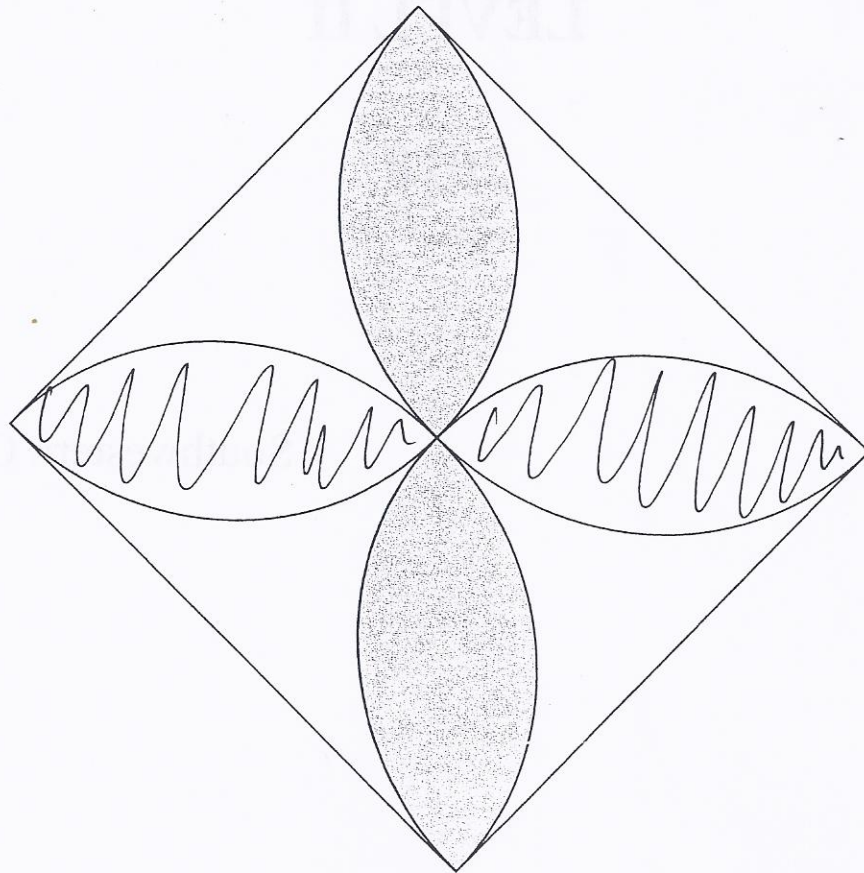
# DUAL DIG

## LEVEL II

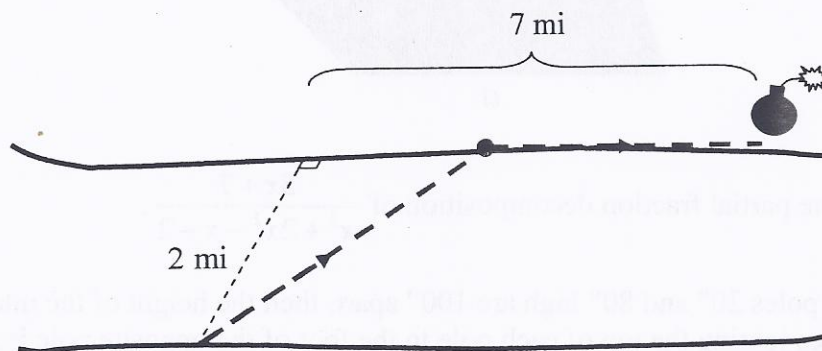
2010

Southwestern College

1. An auditorium has 50 rows of seats. The first row has 20 seats, the second row has 22 seats, the third row has 24 seats, and so on. How many seats are in the auditorium all together?
2. What is the digit in the ones place of  $3^{247}$  ?
3. Find the sum of the coefficients of all the terms after  $(2x - 5y)^5$  is expanded.
4. Calculate  $\sum_{k=0}^{10} 3^{2k}$
5. Find the area of the four-petal flower pictured below. Assume that the petals are created by overlapping half circles and that the outer boundary is a square with sides measuring 6 cm. Give an **EXACT** answer. That is, leave your answer in terms of  $\pi$ .

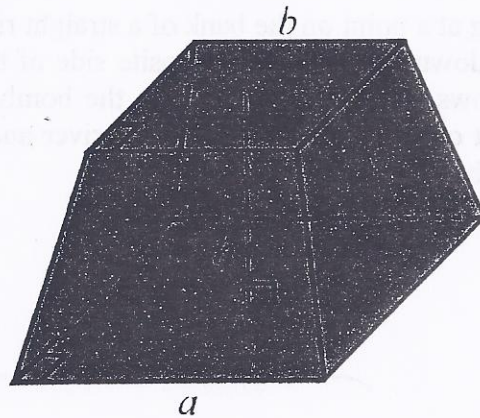


6. Express  $-2\sqrt{3} + 2i$  in polar form.
7. Find all the vertical asymptotes of the function:  $f(x) = \frac{-x^3 - 2x^2 + 3x}{2x^3 + x^2 - 43x - 60}$
8. In a recent year, 389 of the 281,421,906 people in the U.S. were struck by lightning. Estimate the probability that a randomly selected person in the U.S. will be struck by lightning this year.
9. Solve:  ~~$x^4 - 9x^3 + 38x^2 - 90x + 100 = 0$~~   
 $x^4 - 9x^3 + 18x^2 + 30x - 100 = 0$
10. Determine all asymptotes of the function  $f(x) = \frac{3x^2 - x - 2}{x - 1}$
11. **HUH???** All DERFs are ENAJs. One-third of all ENAJs are DERFs. Half of all SIVADs are ENAJs. One SIVAD is a DERF. Eight SIVADs are ENAJs. There are 90 ENAJs. How many ENAJs are neither DERFs nor SIVADs?
12. McClane is standing at a point on the bank of a straight river, 2 miles wide. There is a bomb 7 miles downstream on the opposite side of the bank that he needs to defuse before it blows up. In order to reach the bomb, McClane first needs to swim to some point on the opposite side of the river and then run the remaining distance to the bomb.



He knows that he can swim at 2 mi/h and run at a speed of 5 mi/h. Where should he land so that he reaches the bomb in the fastest time possible?

13. Find the first partial of:  
 $f(x,y) = 4x^3 - 3y^2$
14. If  $f(x) = \log\left(\frac{1+x}{1-x}\right)$  for  $-1 < x < 1$ , then define  $f\left(\frac{3x+x^3}{1+3x^2}\right)$  in terms of  $f(x)$ :
15. The statue of Zeus at Olympia in Greece is one of the Seven Wonders of the World. It is made of gold and ivory. The ivory was found to have lost 35% of its carbon-14. Determine the age of the statue to the nearest year (note: the radioactive element carbon-14 has a half-life of 5750 years).
16. Pictured below is a truncated pyramid. (Think of it as a square base pyramid whose top has been cut horizontally.)  $a$  is the length of a side of the bottom base,  $b$  is the length a side of the top base, and  $h$  is the vertical height between the bases. Find the volume of the truncated pyramid in terms of  $a$ ,  $b$ , and  $h$ .



17. Find the partial fraction decomposition of  $\frac{5x+7}{x^3+2x^2-x-2}$ .
18. If two poles 20" and 80" high are 100" apart, then the height of the intersection of the lines joining the top of each pole to the foot of the opposite pole is:
19. Find real numbers  $x$  and  $y$  such that  $4x + 3iy - 2ix + 6y = 7 + 5i$
20. A math class has an enrollment of 38 students. Suppose that each student had to introduce themselves to everybody else in the class with a handshake. If there can only be one handshake between each pair of students, how many handshakes will there be?