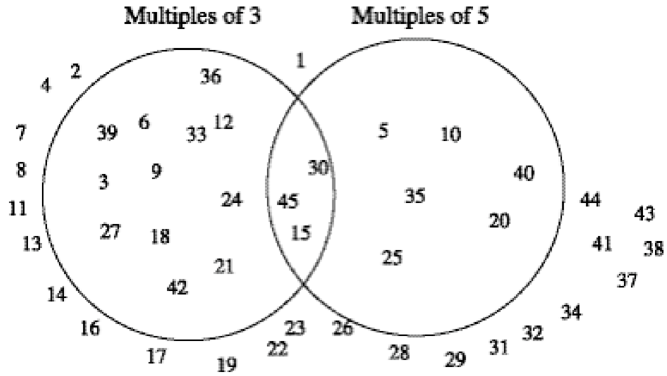
Prime Time: Homework Examples from ACE
Investigation 1: Question 22
Investigation 2: Question 19
Investigation 3: Question 28
Investigation 4: Question 33
Investigation 5: Question 21

	Possible Answers
ACE Investigation 1 **22.** Which set represents all the factors of 12? **F.** {1, 2, 3, 4, 6, 12} **G.** {12, 24, 36, 48…} **H.** {0, 1, 2, 3, 4, 6, 12} **J.** {1, 2, 3, 4, 6}	22. This question checks on vocabulary and understanding. A factor of 12 is a number that divides into 12. Some factors are primes (have no other factors within them). Some are composite (made up of other primes multiplied). F. contains all the factors of 12. Students might systematically check 1, 2, 3, 4, 5, 6, 7 etc. to find all divisors of 12. OR they might find factors in PAIRS; 1 x 12, 2 x 6, 3 x 4. (Notice that finding pairs alerts you to when you can stop looking; 4 x 3, 6 x 2, 12 x 1 are all repeats.) G. contains the multiples of 12. H. contains 0 which is not a factor of 12. *0 is not a divisor of any number.* $\frac{12}{0}$ is undefined. If there were an answer for $\frac{12}{0}$ then 0 would be one part of a factor pair. But we know that there is no answer for the sentence 0 x ? = 12. J. contains the proper factors of 12.
ACE Investigation 2	
19. a. Draw and label a Venn diagram in which one circle represents the multiples of 3 and another circle represents the multiples of 5. Place the whole numbers	19. a. Multiples of 3 are 3, 6, 9, 12,15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45. Multiples of 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45. The common multiples are in both lists. Notice that not every number

from 1 to 45 in the appropriate regions of the diagram. **b.** List four numbers between 1 and 45 that fall in the region outside the circles. **c.** The *common multiples* of 3 and 5—that is, the numbers that are multiples of both 3 and 5—should be in the intersection of the circles. What is the least common multiple of 3 and 5?	between 1 and 45 is in this list because some numbers have neither 3 nor 5 as factors.  b. Possible answers: 2, 4, 7, 8 c. The smallest of the common multiples is 15.
ACE Investigation 3	
28. The cast of the school play had a party at the drama teacher's house. There were 20 cookies and 40 carrot sticks served as refreshments. Each cast member had the same number of whole cookies and the same number of whole carrot sticks, and nothing was left over. The drama teacher did not eat. How many cast members might have been at the party? Explain your answer.	28. Students have to look for common factors of 20 and 40. For example, 5 is a common factor so we can divide 20 cookies into 5 servings (5 people) of 4 cookies each, and we can divide 40 carrot sticks into 5 servings of 8 carrot sticks each. 20 members – each gets 1 cookie and 2 carrot sticks, or 10 – each gets 2 cookies and 4 carrot sticks, or 5 – each gets 4 cookies and 8 carrot sticks, or 4 – each gets 5 cookies and 10 carrot sticks, or 2 – each gets 10 cookies and 20 carrot sticks, or 1 – gets it all: 20 cookies and 40 carrot sticks.
ACE Investigation 4	
33. What is my number? **Clue 1** My number is a perfect square. **Clue 2** The only prime number in its prime factorization is 2.	33. If we take the clues in the order we are given then clue 1 tells us to consider 1x1, 2x2, 3x3, 4x4, 5x5, 6 x 6 etc. Clue 2 tells us to exclude any number that has prime factors other than 2. So we can not use 3x3, or 5x5, or 6x6 (which does have 2 as a factor,

Clue 3 My number is a factor of 32. **Clue 4** The sum of its digits is odd.	but also has 3 as a factor). So now we consider only 2 x2, 4 x 4, 8 x 8, etc. Clue 3 says to consider only 1, 2, 4, 8, 16, 32. Taken with the other clues this leaves us to consider 4 and 16. The last clue narrows this to 16, since 1 + 6 = 7, an odd number. If we take the clues in a different order we will arrive at the same answer. The factors of 32 (clue 3) are 1, 2, 4, 8, and 16 and 32. Of these numbers, only 1, 16 and 32 have digits that add to odd numbers (Clue 4). One and 16 are square numbers. (Clue 1). Of these two numbers, only 16 has 2 in its prime factorization (Clue 2). The number is 16.
ACE Investigation 5	
21. Try to discover a method for finding all the factors of a number using its prime factorization. Use your method to find all the factors of 36. Use the method to find all the factors of 480.	21. To find the prime factorization of 36, students might start with any factor pair, such as 3 x 12, and then break any non-prime part of this pair into smaller factors. This might lead to 3 x 2 x 6, which in turn leads to 3 x 2 x 3 x 2. However they arrive at the prime factorization it will be unique. The prime factorization of 36 is $2 \times 2 \times 3 \times 3$. (Order does not matter.) To find all the factors of 36, use every combination of up to two 2s, and up to two 3s, and don't forget to include 1! Thus, 2 x 2 x 3 must be a factor or 36, but 2 x 2 x 2 x 3 will not be a factor because it contains too many twos. The factors of 36 are 1, 2, 2×2, 3, 3×3, 2×3, $2 \times 2 \times 3$, $2 \times 3 \times 3$, and $2 \times 2 \times 3 \times 3$. The prime factorization of 480 = $2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5$. The factors are 1, 2, 2×2, $2 \times 2 \times 2$, $2 \times 2 \times 2 \times 2$, $2 \times 2 \times 2 \times 2 \times 2$, 3, 2×3, $2 \times 2 \times 3$,

	$2 \times 2 \times 2 \times 3$, $2 \times 2 \times 2 \times 2 \times 3$, $2 \times 2 \times 2 \times 2 \times 2 \times 3$, 5, 2×5, $2 \times 2 \times 5$, $2 \times 2 \times 2 \times 5$, $2 \times 2 \times 2 \times 2 \times 5$, $2 \times 2 \times 2 \times 2 \times 2 \times 5$, 3×5, $2 \times 3 \times 5$, $2 \times 2 \times 3 \times 5$, $2 \times 2 \times 2 \times 3 \times 5$, $2 \times 2 \times 2 \times 2 \times 3 \times 5$, and $2 \times 2 \times 2 \times 2 \times 2 \times 3 \times 5$. **Or,** start with 1 x 480, 2 x 240, 3 x 160, 4 x 120, 5 x 96, 6 x 80, 7 x ? (no whole number factor), 8 x 60, 9 x ? (again 9 is not a factor), 10 x 48 etc. Proceed by trying *every* whole number and record the factor pairs: (1, 480), (2, 240), (3, 160), (4, 120), (5, 96), (6, 80), (8, 60), (10, 48), (12, 40), (15, 32), (16, 30), (20, 24), (24, 20)…. As soon as a factor pair repeats you can stop looking.