8.4 Exercises

CONCEPT CHECK

1. In Euler's Theorem, the variables p and q are _____ numbers.
2. Public-key encryption relies on _____ numbers.
3. True or False: It was said that Julius Caesar communicated with his army using the Julius cipher.

PRACTICE

Verify Euler's Theorem for each given number.

4. $n = 77$, $p = 7$, $q = 11$, $x = 2$, and $a = 1$
5. $n = 91$, $p = 13$, $q = 7$, $x = 3$, and $a = 2$
6. $n = 155$, $p = 31$, $q = 5$, $x = 4$, and $a = 6$

Encode each number using the given public key.

7. Encode the number $M = 14$ using the public key $n = 77$ and $e = 13$.
8. Encode the number $T = 49$ using the public key $n = 77$ and $e = 37$.
9. Encode the number $CC = 101$ using the public key $n = 119$ and $e = 11$.
10. Encode the number $K = 55$ using the public key $n = 119$ and $e = 35$.
11. Encode the number $M = 3$ using the public key $n = 105$ and $e = 10$.
12. Encode the number $A = 8$ using the public key $n = 91$ and $e = 4$.
13. Encode the number $BB = 21$ using the public key $n = 15$ and $e = 2$.
14. Encode the number $J = 100$ using the public key $n = 63$ and $e = 8$.

Decode each number using the given private key.

15. Decode the number $PR = 15$ using the private key $d = 53$ and $n = 77$.
16. Decode the number $TD = 38$ using the private key $d = 17$ and $n = 77$.
17. Decode the number $C = 64$ using the private key $d = 35$ and $n = 221$.
18. Decode the number $W = 219$ using the private key $d = 151$ and $n = 781$.
19. Decode the number $AC = 12$ using the private key $d = 7$ And $n = 77$.

20. Decode the number $B = 35$ using the private key $d = 3$ And $n = 99$.

21. Decode the number $RJ = 21$ using the private key $d = 31$ And $n = 65$.

22. Decode the number $M = 72$ using the private key $d = 11$ And $n = 57$.

Use technology to break each code.

23. Suppose $p = 23$ and $q = 71$. Calculate what d must be if $e = 51$ and $a = 5$.

24. Suppose $p = 17$ and $q = 61$. Calculate what d must be if $e = 71$ and $a = 23$.

25. Suppose $n = 187$ and $e = 19$. Calculate what d must be as well as the two primes p and q, if $a = 7$.

26. Suppose $n = 589$ and $e = 23$. Calculate what d must be as well as the two primes p and q, if $a = 2$.