[1] quotient: $q(x) = 6x^2 - 28$; remainder: $r(x) = 21x^2 + 100x - 69$

[2] quotient: 128; remainder: 104

[3] quotient: $q(x) = 4x^2 - 10x + 30$; remainder: $r(x) = \pm 75x^2 - 34x + 111$

[4] quotient: 9; remainder: 15

[5] 3

[6] 9

[7] $x(3x+4)(x \pm 3)(x+3)$

[8] $(x-4)(x+4)(x-2)(x+2)$

[9] $\pm 2, \frac{3}{4}, 5$

[10] $\pm 1, 0, \frac{3}{2}, 4$

[11] Yes; Checking all the primes less than $\sqrt{1021}$ shows that 1021 is not divisible by any of them. Therefore, 1021 is prime.

[12] No; $3^3 \cdot 7 \cdot 13$

[13] Long division or a CAS shows that $10x^6 - 34x^3 - 24 = (2x^3 - 8)(5x^3 + 3)$. Since $5x^3 + 3$ is a polynomial, $A(x)$ is a factor of $B(x)$.

[14] Long division or a CAS shows that $10x^5 - x^3 - 21x = (2x^2 - 3)(5x^3 + 7x)$. Since $2x^2 - 3$ is a polynomial, $A(x)$ is a factor of $B(x)$.

[15] 6

[16] 0

[17] When $f(x) = 3x^4 - 10x^3 - 9x - 14$ is divided by $x \pm 4$, the remainder is 78, so by the Remainder Theorem, $f(4) = 78$.

[18] When $f(x) = x^4 - 4x^3 + 3x^2 - 12x - 10$ is divided by $x + 2$, the remainder is 74, so by the Remainder Theorem, $f(\pm 2) = 74$.

[19] $f(x) = (x-a)^2(x-b)^3(x-c)$

[20] $f(x) = \pm(x-a)^3(x-c)^2(x-d)$

[21] 7

[22] 2

[23] Answers vary. Sample: Suppose that n is a prime number and $n+1$ is also a prime number. Since $n+1$ is a prime number, it is not a multiple of 2. So, $n+1 \equiv 1 (\text{mod } 2)$. Then, since $1 \equiv 1 (\text{mod} 2)$, $n+1 \pm 1 \equiv 1 \pm 1 (\text{mod } 2) \equiv 0 (\text{mod} 2)$ by the Subtraction Property of Congruence. Thus, $n \equiv 0 (\text{mod} 2)$, so n is a multiple of 2. But this is a contradiction because n is prime. Thus, $n+1$ must not be a prime number.

[24] Answers vary. Sample: Suppose that n is a positive integer and n^2 is a multiple of 2, but n is not a multiple of 2. Since n is not a multiple of 2, $n \equiv 1 (\text{mod} 2)$. By the Multiplication Property of Congruence $n^2 \equiv 1^2 (\text{mod } 2) \equiv 1 (\text{mod} 2)$. But this is a contradiction because n^2 is a multiple of 2. Thus, n must be a multiple of 2.

[25] 6

[26] 40

[27] \$132

[28] 8

[29] Tuesday

[30] Saturday at 6 P.M.

[31] 11011010011_2

[32] 101001111010_2

[33] 1001001_2

[34] 110110_2