

#1 – 20 Find all the zeros of the following functions. Also write the functions in factored form, factoring completely over the complex numbers. (If it is an  $n$ th degree function, then when you write it in factored form it should have  $n$  linear factors.)

1)  $f(x) = x^2 + 25$

11)  $f(x) = 16x^3 - 20x^2 - 4x + 15$

2)  $f(x) = x^2 - x + 56$

12)  $f(s) = 2s^3 - 5s^2 + 12s - 5$

3)  $h(x) = x^2 - 4x + 1$

13)  $f(x) = 5x^3 - 9x^2 + 28x + 6$

4)  $g(x) = x^2 + 10x + 23$

14)  $g(x) = 3x^3 - 4x^2 + 8x + 8$

5)  $f(x) = x^4 - 81$

15)  $f(x) = x^4 + 10x^2 + 9$

6)  $f(y) = y^4 - 625$

16)  $f(x) = x^4 + 29x^2 + 100$

7)  $f(z) = z^2 - 2z + 2$

17)  $g(x) = x^4 - 4x^3 + 8x^2 - 16x + 16$

8)  $h(x) = x^3 - 3x^2 + 4x - 2$

18)  $h(x) = x^4 + 6x^3 + 10x^2 + 6x + 9$

9)  $f(t) = t^3 - 3t^2 - 15t + 125$

19)  $f(x) = 2x^4 + 5x^3 + 4x^2 + 5x + 2$

10)  $f(x) = x^3 + 11x^2 + 39x + 29$

20)  $g(x) = x^5 - 8x^4 + 28x^3 - 56x^2 + 64x - 32$

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Answers:

1)  $\{\pm 5i\}$ ,  $f(x) = (x - 5i)(x + 5i)$

2)  $\left\{\frac{1 \pm i\sqrt{223}}{2}\right\}$ ,  $f(x) = \left(x - \left(\frac{1 + i\sqrt{223}}{2}\right)\right)\left(x - \left(\frac{1 - i\sqrt{223}}{2}\right)\right)$

3)  $\{2 \pm \sqrt{3}\}$ ,  $h(x) = (x - (2 + \sqrt{3}))(x - (2 - \sqrt{3}))$  or  $h(x) = (x - 2 - \sqrt{3})(x - 2 + \sqrt{3})$

4)  $\{-5 \pm \sqrt{2}\}$ ,  $g(x) = (x + 5 - \sqrt{2})(x + 5 + \sqrt{2})$

5)  $\{\pm 3, \pm 3i\}$ ,  $f(x) = (x - 3)(x + 3)(x - 3i)(x + 3i)$

(answers continued on back)

- 6)  $\{\pm 5, \pm 5i\}$ ,  $f(y) = (y-5)(y+5)(y-5i)(y+5i)$
- 7)  $\{1 \pm i\}$ ,  $f(z) = (z-1-i)(z-1+i)$
- 8)  $\{1, 1 \pm i\}$ ,  $h(x) = (x-1)(x-1-i)(x-1+i)$
- 9)  $\{-5, 4 \pm 3i\}$ ,  $f(t) = (t+5)(t-(4+3i))(t-(4-3i))$
- 10)  $\{-1, -5 \pm 2i\}$ ,  $f(x) = (x+1)(x+5-2i)(x+5+2i)$
- 11)  $\left\{-\frac{3}{4}, \frac{2 \pm i}{2}\right\}$ ,  $f(x) = 4(4x+3)\left(x - \left(\frac{2+i}{2}\right)\right)\left(x - \left(\frac{2-i}{2}\right)\right)$
- 12)  $\left\{\frac{1}{2}, 1 \pm 2i\right\}$ ,  $f(s) = (2s-1)(s-(1+2i))(s-(1-2i))$
- 13)  $\left\{-\frac{1}{5}, 1 \pm i\sqrt{5}\right\}$ ,  $f(x) = (5x+1)\left(x - (1+i\sqrt{5})\right)\left(x - (1-i\sqrt{5})\right)$
- 14)  $\left\{-\frac{2}{3}, 1 \pm i\sqrt{3}\right\}$ ,  $g(x) = (3x+2)\left(x - (1+i\sqrt{3})\right)\left(x - (1-i\sqrt{3})\right)$
- 15)  $\{\pm i, \pm 3i\}$ ,  $f(x) = (x-i)(x+i)(x-3i)(x+3i)$
- 16)  $\{\pm 2i, \pm 5i\}$ ,  $f(x) = (x-2i)(x+2i)(x-5i)(x+5i)$
- 17)  $\{2, \pm 2i\}$ ,  $g(x) = (x-2)^2(x-2i)(x+2i)$
- 18)  $\{-3, \pm i\}$ ,  $h(x) = (x+3)^2(x-i)(x+i)$
- 19)  $\left\{-2, -\frac{1}{2}, \pm i\right\}$ ,  $f(x) = (x+2)(2x+1)(x-i)(x+i)$
- 20)  $\{2, 1 \pm i\sqrt{3}\}$ ,  $g(x) = (x-2)^3\left(x - (1+i\sqrt{3})\right)\left(x - (1-i\sqrt{3})\right)$