

A.APR.B.3: Solving Polynomial Equations 1

- 1 When factoring to reveal the roots of the equation $x^3 + 2x^2 - 9x - 18 = 0$, which equations can be used?
- $x^2(x+2) - 9(x+2) = 0$
 - $x(x^2 - 9) + 2(x^2 - 9) = 0$
 - $(x-2)(x^2 - 9) = 0$
- I and II, only
 - I and III, only
 - II and III, only
 - I, II, and III
- 2 How many negative solutions to the equation $2x^3 - 4x^2 + 3x - 1 = 0$ exist?
- 1
 - 2
 - 3
 - 0
- 3 The zeros of the function $f(x) = x^3 - 9x^2$ are
- 9, only
 - 0 and 9
 - 0 and 3, only
 - 3, 0, and 3
- 4 Which values of x are solutions of the equation $x^3 + x^2 - 2x = 0$?
- 0, 1, 2
 - 0, 1, -2
 - 0, -1, 2
 - 0, -1, -2
- 5 The zeros of the function $f(x) = 2x^3 + 12x - 10x^2$ are
- {2, 3}
 - {-1, 6}
 - {0, 2, 3}
 - {0, -1, 6}
- 6 Given $c(m) = m^3 - 2m^2 + 4m - 8$, the solution of $c(m) = 0$ is
- ± 2
 - 2, only
 - $2i, 2$
 - $\pm 2i, 2$
- 7 Evan graphed a cubic function, $f(x) = ax^3 + bx^2 + cx + d$, and determined the roots of $f(x)$ to be ± 1 and 2. What is the value of b , if $a = 1$?
- 1
 - 2
 - 1
 - 2
- 8 Which statement regarding polynomials and their zeros is true?
- $f(x) = (x^2 - 1)(x + a)$ has zeros of 1 and $-a$, only.
 - $f(x) = x^3 - ax^2 + 16x - 16a$ has zeros of 4 and a , only.
 - $f(x) = (x^2 + 25)(x + a)$ has zeros of ± 5 and $-a$.
 - $f(x) = x^3 - ax^2 - 9x + 9a$ has zeros of ± 3 and a .
- 9 What are the zeros of $P(m) = (m^2 - 4)(m^2 + 1)$?
- 2 and -2, only
 - 2, -2, and -4
 - 4, i , and $-i$
 - 2, -2, i , and $-i$
- 10 Given $f(x) = x^4 + x^3 - 3x^2 + 9x - 108$ and $f(3) = 0$, which values satisfy $f(x) = 0$?
- 4, 3 only
 - 3, 4 only
 - $\pm 3i, -4, 3$
 - $\pm 3i, -3, 4$

- 11 The zeros for $f(x) = x^4 - 4x^3 - 9x^2 + 36x$ are
- 1) $\{0, \pm 3, 4\}$
 - 2) $\{0, 3, 4\}$
 - 3) $\{0, \pm 3, -4\}$
 - 4) $\{0, 3, -4\}$
- 12 What is the solution set of the equation $3x^5 - 48x = 0$?
- 1) $\{0, \pm 2\}$
 - 2) $\{0, \pm 2, 3\}$
 - 3) $\{0, \pm 2, \pm 2i\}$
 - 4) $\{\pm 2, \pm 2i\}$
- 13 What are the zeros of $s(x) = x^4 - 9x^2 + 3x^3 - 27x - 10x^2 + 90$?
- 1) $\{-3, -2, 5\}$
 - 2) $\{-2, 3, 5\}$
 - 3) $\{-3, -2, 3, 5\}$
 - 4) $\{-5, -3, 2, 3\}$
- 14 Given 3 is a root of $f(x) = x^4 - x^3 - 21x^2 + 45x$, what are the other unique roots of $f(x)$?
- 1) -5 , only
 - 2) -5 and 0
 - 3) -3 , 1 and 5
 - 4) -5 , -3 and 0
- 15 Determine algebraically the zeros of $f(x) = 3x^3 + 21x^2 + 36x$.
- 16 Solve the equation $2x^3 - x^2 - 8x + 4 = 0$ algebraically for all values of x .
- 17 Algebraically determine the zeros of the function below.
- $$r(x) = 3x^3 + 12x^2 - 3x - 12$$
- 18 Solve the equation $8x^3 + 4x^2 - 18x - 9 = 0$ algebraically for all values of x .
- 19 Solve $x^3 + 5x^2 = 4x + 20$ algebraically.
- 20 Solve algebraically for all values of x : $x^4 + 4x^3 + 4x^2 = -16x$
- 21 Solve, giving 4 roots, $x^4 - 13x^2 + 36 = 0$
- 22 Solve: $x^4 - 3x^2 = 4$ (Find 4 roots.)
- 23 Given $z(x) = 6x^3 + bx^2 - 52x + 15$, $z(2) = 35$, and $z(-5) = 0$, algebraically determine all the zeros of $z(x)$.

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Answer Section

1 ANS: 1

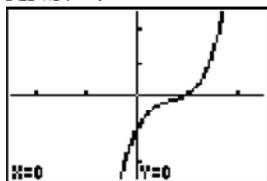
$$x^3 + 2x^2 - 9x - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0 \quad x^3 - 9x + 2x^2 - 18 = 0$$

$$x^2(x+2) - 9(x+2) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0 \quad x(x^2 - 9) + 2(x^2 - 9) = 0$$

$$(x+2)(x^2 - 9) = 0$$

REF: 011903aai

2 ANS: 4



REF: 061222a2

3 ANS: 2

$$f(x) = x^3 - 9x^2 = x^2(x - 9) = 0$$

$$x = 0, 9$$

REF: 012009ai

4 ANS: 2

$$x^3 + x^2 - 2x = 0$$

$$x(x^2 + x - 2) = 0$$

$$x(x+2)(x-1) = 0$$

$$x = 0, -2, 1$$

REF: 011103a2

5 ANS: 3

$$2x^3 + 12x - 10x^2 = 0$$

$$2x(x^2 - 5x + 6) = 0$$

$$2x(x-3)(x-2) = 0$$

$$x = 0, 2, 3$$

REF: 081719ai

6 ANS: 4

$$m^3 - 2m^2 + 4m - 8 = 0$$

$$m^2(m-2) + 4(m-2) = 0$$

$$(m^2 + 4)(m-2) = 0$$

REF: 081821aii

7 ANS: 4

$$f(x) = (x+1)(x-1)(x-2) = (x^2-1)(x-2) = x^3 - 2x^2 - x + 2$$

REF: 081921aii

8 ANS: 4

1) -1 is also a zero. 2) $x^2(x-a) + 16(x-a) = (x^2+16)(x-a)$ a is the only zero. 3) $-a$ is the only zero. 4) $x^2(x-a) - 9(x-a) = (x^2-9)(x-a)$.

REF: 012019aii

9 ANS: 4

REF: 081708aii

10 ANS: 3

$$3 \mid 1 \ 1 \ -3 \ 9 \ -108 \quad x^3 + 4x^2 + 9x + 36 = 0$$

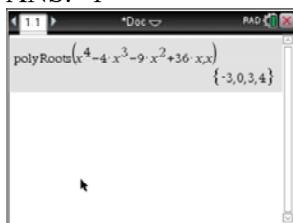
$$\begin{array}{r} 3 \ 12 \ 27 \ 108 \\ \hline 1 \ 4 \ 9 \ 36 \ 0 \end{array} \quad x^2(x+4) + 9(x+4) = 0$$

$$(x^2 + 9)(x+4) = 0$$

$$x = \pm 3i, -4$$

REF: 062420aii

11 ANS: 1



$$x^4 - 4x^3 - 9x^2 + 36x = 0$$

$$x^3(x-4) - 9x(x-4) = 0$$

$$(x^3 - 9x)(x-4) = 0$$

$$x(x^2 - 9)(x-4) = 0$$

$$x(x+3)(x-3)(x-4) = 0$$

$$x = 0, \pm 3, 4$$

REF: 061606aii

12 ANS: 3

$$3x^5 - 48x = 0$$

$$3x(x^4 - 16) = 0$$

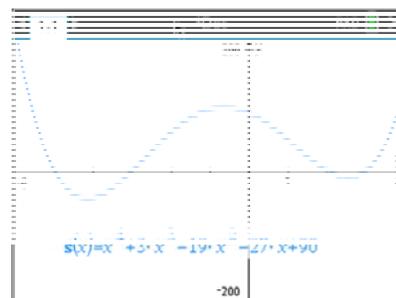
$$3x(x^2 + 4)(x^2 - 4) = 0$$

$$3x(x^2 + 4)(x + 2)(x - 2) = 0$$

REF: 011216a2

13 ANS: 4

$$s(x) = x^4 - 9x^2 + 3x^3 - 27x - 10x^2 + 90 = x^4 + 3x^3 - 19x^2 - 27x + 90$$



REF: 062303a11

14 ANS: 2

$$\begin{array}{cccccc} 3 & 1 & -1 & -21 & 45 & 0 \\ & & 3 & 6 & -45 & 0 \\ & & 1 & 2 & -15 & 0 & 0 \end{array}$$

$$x^3 + 2x^2 - 15x = 0$$

$$x(x^2 + 2x - 15) = 0$$

$$x(x + 5)(x - 3) = 0$$

$$x = 0, -5, 3$$

REF: 012403a11

15 ANS:

$$3x^3 + 21x^2 + 36x = 0$$

$$3x(x^2 + 7x + 12) = 0$$

$$3x(x + 4)(x + 3) = 0$$

$$x = 0, -4, -3$$

REF: 011930a1

16 ANS:

$$x^2(2x-1) - 4(2x-1) = 0$$

$$(x^2 - 4)(2x - 1) = 0$$

$$(x+2)(x-2)(2x-1) = 0$$

$$x = \pm 2, \frac{1}{2}$$

REF: 081537a2

17 ANS:

$$3(x^3 + 4x^2 - x - 4) = 0$$

$$(x^2(x+4) - (x+4)) = 0$$

$$(x^2 - 1)(x+4) = 0$$

$$x = \pm 1, -4$$

REF: 012325aia

18 ANS:

$$\pm \frac{3}{2}, -\frac{1}{2}. \quad 8x^3 + 4x^2 - 18x - 9 = 0$$

$$4x^2(2x+1) - 9(2x+1) = 0$$

$$(4x^2 - 9)(2x+1) = 0$$

$$4x^2 - 9 = 0 \text{ or } 2x + 1 = 0$$

$$(2x+3)(2x-3) = 0 \quad x = -\frac{1}{2}$$

$$x = \pm \frac{3}{2}$$

REF: fall0937a2

19 ANS:

$$x^3 + 5x^2 - 4x - 20 = 0$$

$$x^2(x+5) - 4(x+5) = 0$$

$$(x^2 - 4)(x+5) = 0$$

$$(x+2)(x-2)(x+5) = 0$$

$$x = \pm 2, -5$$

REF: 061437a2

20 ANS:

$$x^4 + 4x^3 + 4x^2 + 16x = 0$$

$$x(x^3 + 4x^2 + 4x + 16) = 0$$

$$x(x^2(x+4) + 4(x+4)) = 0$$

$$x(x^2 + 4)(x + 4) = 0$$

$$x = 0, \pm 2i, -4$$

REF: 061339a2

21 ANS:

$$\pm 2, \pm 3$$

REF: 089604a1

22 ANS:

$$\pm 2, \pm i$$

REF: 069407a1

23 ANS:

$$0 = 6(-5)^3 + b(-5)^2 - 52(-5) + 15 \quad z(x) = 6x^3 + 19x^2 - 52x + 15$$

$$0 = -750 + 25b + 260 + 15$$

$$475 = 25b$$

$$19 = b$$

$$\begin{array}{r|rrrr} -5 & 6 & 19 & -52 & 15 \\ & & -30 & 55 & 15 \\ \hline & 6 & -11 & 3 & 0 \end{array}$$

$$6x^2 - 11x + 3 = 0$$

$$(2x - 3)(3x - 1) = 0$$

$$x = \frac{3}{2}, \frac{1}{3}, -5$$

REF: fall1515a11