Precalculus – Math 1113

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Test 1 Review Video

A **polynomial function**

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$$

Rational Function

$$R(x) = \frac{p(x)}{q(x)} = \frac{a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0}{b_m x^m + b_{m-1} x^{m-1} + \cdots + b_1 x + b_0}$$

1. Give the equation of the horizontal asymptote, if any, of the function.

$$h(x) = \frac{2x^2 - 7x - 2}{3x^2 - 9x + 4}$$

- **A.** $y = \frac{2}{3}$
- **B.** $y = \frac{7}{9}$
- **C.** $y = 0$
- **D.** no horizontal asymptotes

2. State whether the function is a polynomial function or not. If it is, give its degree. If it is not, tell why not.

$f(x) = x(x - 12)$

- **A.** Yes; degree 2
- **B.** No; it is a product
- **C.** Yes; degree 1
- **D.** Yes; degree 0

3. State whether the function is a polynomial function or not. If it is, give its degree. If it is not, tell why not.

$f(x) = 2 - \frac{1}{x^3}$

- **A.** Yes; degree 3
- **B.** Yes; degree $\frac{1}{3}$
- **C.** Yes; degree -3
- **D.** No; x is raised to the negative 3 power

4. For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x-axis at each x-intercept.

$f(x) = 5\left(x^2 + 1\right)(x + 4)^2$

- **A.** -1, multiplicity 1, touches x-axis; -4, multiplicity 2, crosses x-axis
- **B.** -1, multiplicity 1, crosses x-axis; -4, multiplicity 2, touches x-axis
- **C.** -4, multiplicity 2, crosses x-axis
- **D.** -4, multiplicity 2, touches x-axis

5. For the polynomial, list each real zero and its multiplicity. Determine whether the graph crosses or touches the x-axis at each x-intercept.

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

- **A.** 2, multiplicity 2, touches x-axis
- **B.** -1, multiplicity 1, touches x-axis; 2, multiplicity 2, crosses x-axis
- **C.** -1, multiplicity 1, crosses x-axis; 2, multiplicity 2, touches x-axis
- **D.** 2, multiplicity 2, crosses x-axis

6. Form a polynomial whose zeros and degree are given.

Zeros: -2, multiplicity 2; 2, multiplicity 1; degree 3

- **A.** $x^3 - 2x^2 - 4x + 8$
- **B.** $x^3 + 4x^2 - 4x - 8$
- **C.** $x^3 - 2x^2 - 8x + 8$
- **D.** $x^3 + 2x^2 - 4x - 8$

7. Use the x-intercepts to find the intervals on which the graph of f is above and below the x-axis.

$f(x) = \left(x - \frac{1}{2}\right)^4 (x-4)^5$

- **A.** above the x-axis: $\left(-\infty, \frac{1}{2}\right), \left(\frac{1}{2}, 4\right)$; below the x-axis: $(4, \infty)$
- **B.** above the x-axis: $\left(-\infty, \frac{1}{2}\right), (4, \infty)$; below the x-axis: $\left(\frac{1}{2}, 4\right)$
- **C.** above the x-axis: $(4, \infty)$; below the x-axis: $\left(-\infty, \frac{1}{2}\right), \left(\frac{1}{2}, 4\right)$
- **D.** above the x-axis: $\left(\frac{1}{2}, 4\right)$; below the x-axis: $\left(-\infty, \frac{1}{2}\right), (4, \infty)$

8. Find the x-and y-intercepts of f.

$f(x) = 49x - x^3$

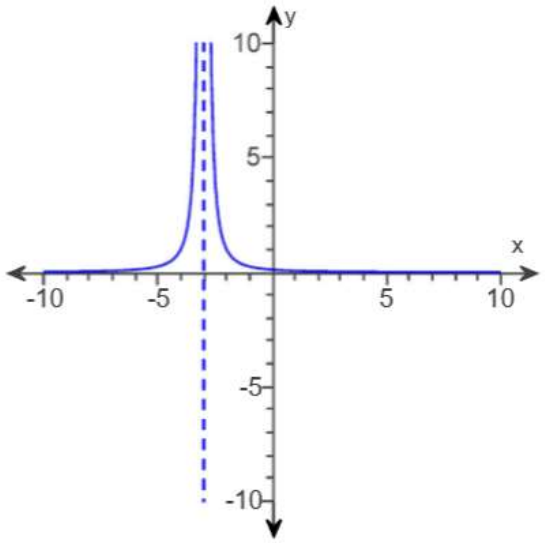
- **A.** x-intercepts: 0, − 7; y-intercept: 0
- **B.** x-intercepts: 0, − 7; y-intercept: 7
- **C.** x-intercepts: 0, 7, − 7; y-intercept: 0
- **D.** x-intercepts: 0, 7, − 7; y-intercept: 7

9. Find the vertical asymptotes of the rational function.

$$f(x) = \frac{-2x(x+2)}{4x^2 - 3x - 7}$$

- **A.** $x = -\frac{7}{4}, x = 1$
- **B.** $x = \frac{4}{7}, x = -1$
- **C.** $x = -\frac{4}{7}, x = 1$
- **D.** $x = \frac{7}{4}, x = -1$

10. Use the graph to find the vertical asymptotes, if any, of the function.



- **A.** $y = -3$
- **B.** $x = -3, x = 0$
- **C.** $x = -3$
- **D.** none

11. Give the equation of the oblique asymptote, if any, of the function.

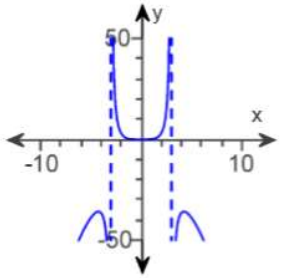
$$f(x) = \frac{x^2 - 5x + 9}{x + 5}$$

- **A.** $y = x - 10$
- **B.** $y = x + 14$
- **C.** $x = y + 5$
- **D.** no oblique asymptote

12. Graph the function.

$$f(x) = \frac{x^4 - 1}{x^2 - 9}$$

A.



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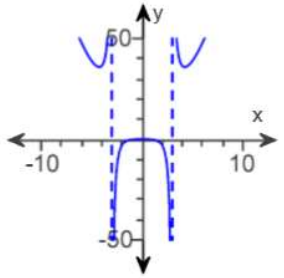
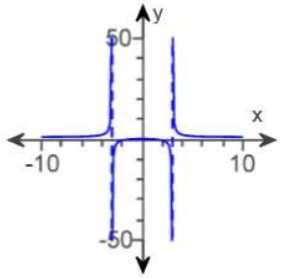
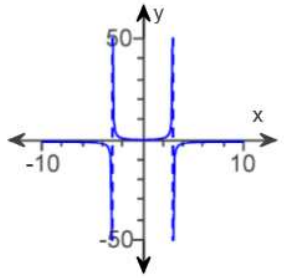


C.



D.



13. Give the equation of the horizontal asymptote, if any, of the function.

$$R(x) = \frac{-3x^2}{x^2 + 4x - 32}$$

- **A.** $y = 0$
- **B.** $y = -8, y = 4$
- **C.** $y = -3$
- **D.** no horizontal asymptotes

14. Find the indicated intercept(s) of the graph of the function.

y-intercept of $f(x) = \dfrac{x^3 - 6}{x^2 + 3}$

- **A.** $(0, -2)$
- **B.** $(0, -6)$
- **C.** $(0,10)$
- **D.** none

15. Economists use what is called a Leffer curve to predict the government revenue for tax rates from 0% to 100%. Economists agree that the end points of the curve generate 0 revenue, but disagree on the tax rate that produces the maximum revenue. Suppose an economist produces this rational function $R(x) = \frac{10x(100 - x)}{75 + x}$, where R is revenue in millions at a tax rate of x percent. Use a graphing calculator to graph the function. What tax rate produces the maximum revenue? What is the maximum revenue?

- **A.** 39.6%; $209 million
- **B.** 35.8%; $209 million
- **C.** 37.5%; $210 million
- **D.** 34.9%; $207 million

16. Solve the inequality.

$(a+7)(a-5)(a-7)>0$

- **A.** $(-7,5)$ or $(7,\infty)$
- **B.** $(-\infty,-7)$ or $(5,7)$
- **C.** $(-\infty,5)$
- **D.** $(7,\infty)$

17. Use the Rational Zeros Theorem to find all the real zeros of the polynomial function. Use the zeros to factor f over the real numbers.

$f(x) = 4x^4 - 7x^3 + 11x^2 - 14x + 6$

- **A.** $2, \frac{3}{4}; \ f(x) = (x-2)(4x-3)(x^2+1)$
- **B.** $-2, -1, 1, -\frac{3}{4}; \ f(x) = (x-1)(4x+3)(x+1)(x+2)$
- **C.** $-2, -1, 1, \frac{3}{4}; \ f(x) = (x-1)(4x-3)(x+1)(x+2)$
- **D.** $1, \frac{3}{4}; \ f(x) = (x-1)(4x-3)(x^2+2)$

18. Use the Rational Zeros Theorem to find all the real zeros of the polynomial function. Use the zeros to factor f over the real numbers.

$f(x) = 5x^4 - 40x^3 + 81x^2 - 8x + 16$

- **A.** 4, multiplicity 2; $f(x) = (x-4)^2\left(5x^2+1\right)$
- **B.** -4, 4; $f(x) = (x-4)(x+4)\left(5x^2+1\right)$
- **C.** no real roots; $f(x) = \left(x^2+16\right)\left(5x^2+1\right)$
- **D.** -4, multiplicity 2; $f(x) = (x+4)^2\left(5x^2+1\right)$

19. Find the intercepts of the function f(x).

$f(x) = (x + 6)(x - 5)(x + 5)$

- **A.** x-intercepts: $-6, -5, 5$; y-intercept: -150
- **B.** x-intercepts: $-5, 5, 6$; y-intercept: 150
- **C.** x-intercepts: $-5, 5, 6$; y-intercept: -150
- **D.** x-intercepts: $-6, -5, 5$; y-intercept: 150

20. Solve the equation in the real number system.

$2x^4 - 2x^3 + x^2 - 5x - 10 = 0$

- **A.** $\{-1, 2\}$
- **B.** $\left\{-\frac{\sqrt{10}}{2}, \frac{\sqrt{10}}{2}\right\}$
- **C.** $\{1, -2\}$
- **D.** $\left\{-\frac{5}{2}, \frac{5}{2}\right\}$

21. Information is given about a polynomial f(x) whose coefficients are real numbers. Find the remaining zeros of f.

Degree 6; zeros: $2, 2+i, -4-i, 0$

- **A.** $2-i, -4+i$
- **B.** $-2, 2-i, -4+i$
- **C.** $-2-i, 4+i$
- **D.** $-2+i, 4-i$

22. Form a polynomial f(x) with real coefficients having the given degree and zeros.

Degree: 4; zeros: -1, 2 and $1-2i$.

- **A.** $f(x) = x^4 - x^3 + 3x^2 - 5x - 10$
- **B.** $f(x) = x^4 - x^3 + x^2 + 9x - 10$
- **C.** $f(x) = x^4 - 3x^3 - 3x^2 + 7x + 6$
- **D.** $f(x) = x^4 - 3x^3 + 5x^2 - x - 10$

23. Find all zeros of the function and write the polynomial as a product of linear factors.

$f(x) = x^4 + 5x^3 + 15x^2 + 45x + 54$

- **A.** $f(x) = \left(x - i\sqrt{6}\right)\left(x + i\sqrt{6}\right)(x-3)(x+3)$
- **B.** $f(x) = (x-2)(x+3)(x-3)(x+3)$
- **C.** $f(x) = (x-1)(x-6)(x-3i)(x+3i)$
- **D.** $f(x) = (x+2)(x+3)(x-3i)(x+3i)$

24. Find all zeros of the function and write the polynomial as a product of linear factors.

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

- **A.** $f(x) = (x - 1)(x + 2i)(x - 2i)$
- **B.** $f(x) = (x - 1)(x + 1)(x + 4)$
- **C.** $f(x) = (x - 25)(x + i)(x - i)$
- **D.** $f(x) = (x - 1)(x + 2)(x - 2)$

25 Use the given zero to find the remaining zeros of the function.

$f(x) = x^3 - 3x^2 - 5x + 39$; zero: -3

- **A.** $1 + 2i, 1 - 2i$
- **B.** $3 + 2i, 3 - 2i$
- **C.** $1 + 2\sqrt{13}\,i, 1 - 2\sqrt{13}\,i$
- **D.** $6 + 4i, 6 - 4i$

26 Find all zeros of the function and write the polynomial as a product of linear factors.

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

- **A.** $f(x) = (x + 1)\left(x + 3 + i\sqrt{3}\right)\left(x - 2 - i\sqrt{3}\right)$
- **B.** $f(x) = (x - 1)\left(x + 3 + i\sqrt{3}\right)\left(x + 3 - i\sqrt{3}\right)$
- **C.** $f(x) = (x - 2)(x + 3 + i)(x + 3 - i)$
- **D.** $f(x) = (x - 2)(x + 3 + i)(x - 3 - i)$

27 Information is given about a polynomial f(x) whose coefficients are real numbers. Find the remaining zeros of f.

Degree 5; zeros: 2, i, $2i$

- **A.** $-2, -i$
- **B.** $-2, -i, -2i$
- **C.** $-2, -2i$
- **D.** $-i, -2i$

Key 1A, 2A, 3D, 4D, 5A, 6D, 7C, 8C, 9D, 10C, 11A, 12B, 13C, 14A,

15A, 16A, 17D, 18A, 19A, 20A, 21A, 22D, 23D, 24A, 25B , 26C, 27D