

Tishk International University
 Architectural Engineering Department
 First Grade
 Fall semester 2024-2025

Question Bank

Lecture -4-

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Question Samples



Q1. What is a polynomial function?

Q2. Which of the following functions are polynomial functions?

- (a) $f(x) = 4x^2 + 2$ (b) $f(x) = 3x^3 - 2x + \sqrt{x}$ (c) $f(x) = 12 - 4x^5 + 3x^2$
 (d) $f(x) = \sin x + 1$ (e) $f(x) = 3x^{12} - 2/x$ (f) $f(x) = 3x^{11} - 2x^{12}$

Q3. Write down one example of each of the following types of polynomial function:

- (a) cubic (b) linear (c) quartic (d) quadratic

Q4. Sketch the graphs of the following functions on the same axes:

- (a) $f(x) = x^2$ (b) $f(x) = 4x^2$ (c) $f(x) = -x^2$ (d) $f(x) = -4x^2$

Q5. Consider a function of the form $f(x) = x^2 + ax$, where a represents a real number. The graph of this function is represented by a parabola.

- (a) When $a > 0$, what happens to the parabola as a increases?
 (b) When $a < 0$, what happens to the parabola as a decreases?

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Q6. Write down a polynomial function with roots:

- (a) 1, 2, 3, 4 (b) 2, -4 (c) 12, -1, -6

Q7. Write down the roots and identify their multiplicity for each of the following functions:

(a) $f(x) = (x - 2)^3(x + 4)^4$ (b) $f(x) = (x - 1)(x + 2)^2(x - 4)^3$

Q8. Sketch the following functions:

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

Q9. Match each polynomial function with its graph. Explain your reasoning.

a. $f(x) = x^3 - x$

b. $f(x) = -x^3 + x$

c. $f(x) = -x^4 + 1$

d. $f(x) = x^4$

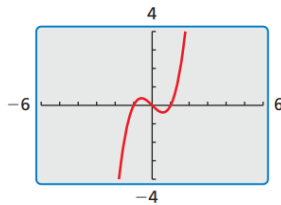
e. $f(x) = x^3$

f. $f(x) = x^4 - x^2$

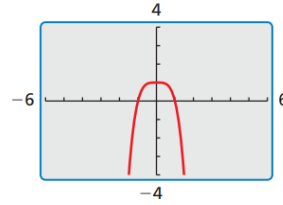
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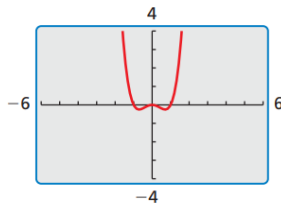
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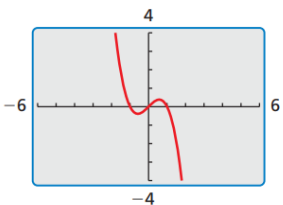
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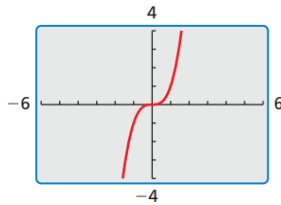
C.



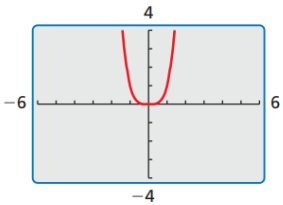
D.



E.



F.



4



Q10. Decide whether each function is a polynomial function. If so, write it in standard form and state its degree, type, and leading coefficient.

a. $f(x) = -2x^3 + 5x + 8$

b. $g(x) = -0.8x^3 + \sqrt{2}x^4 - 12$

c. $h(x) = -x^2 + 7x^{-1} + 4x$

d. $k(x) = x^2 + 3^x$

Q11. Graph

(a) $f(x) = -x^3 + x^2 + 3x - 3$ and

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

Q12. Which one doesn't belong? Which function does not belong with the other three? Explain your reasoning.

$$f(x) = 7x^5 + 3x^2 - 2x$$

$$g(x) = 3x^3 - 2x^8 + \frac{3}{4}$$

$$h(x) = -3x^4 + 5x^{-1} - 3x^2$$

$$k(x) = \sqrt{3}x + 8x^4 + 2x + 1$$

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Q13. Decide whether the function is a polynomial function. If so, write it in standard form and state its degree, type, and leading coefficient.

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

$$p(x) = \frac{1}{2}x^2 + 3x - 4x^3 + 6x^4 - 1$$

$$f(x) = 9x^4 + 8x^3 - 6x^{-2} + 2x$$

$$g(x) = \sqrt{3} - 12x + 13x^2$$

$$h(x) = \frac{5}{3}x^2 - \sqrt{7}x^4 + 8x^3 - \frac{1}{2} + x$$

$$h(x) = 3x^4 + 2x - \frac{5}{x} + 9x^3 - 7$$

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Q14. Sketch a graph of the following polynomial:

$$f(x) = (x-3)(x+2)(x-5)$$

$$f(x) = (x-3)(x+2)(x-5)^2$$

$$f(x) = x^5 - 9x^3$$

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Q15. Find the x and y intercepts. State the degree of the function. Sketch the graph of

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

Q16. Find the x and y intercepts. State the degree of the function. Sketch the graph of

$$P(x) = (x-3)^2(x+1)^5(x+2)^3$$

Q17. Find the x and y intercepts. State the degree of the function. Sketch the graph of

$$g(x) = (3-x)(x+1)(x+5)^2$$

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Q18. Finding the x-Intercepts of a Polynomial Function by Factoring

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

Q19. Finding the x-Intercepts of a Polynomial Function by Factoring

$$f(x) = x^3 - 5x^2 - x + 5.$$

Q20. Finding the y- and x-Intercepts of a Polynomial in Factored Form

$$g(x) = (x - 2)^2(2x + 3).$$

Q21. Finding the y- and x-Intercepts of a Polynomial in Factored Form

$$h(x) = x^3 + 4x^2 + x - 6$$

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Q22. Decide whether the function is a polynomial function. If so, write it in standard form and state its degree, type, and leading coefficient.

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

$$p(x) = \frac{1}{2}x^2 + 3x - 4x^3 + 6x^4 - 1$$

$$f(x) = 9x^4 + 8x^3 - 6x^{-2} + 2x$$

$$g(x) = \sqrt{3} - 12x + 13x^2$$

$$h(x) = \frac{5}{3}x^2 - \sqrt{7}x^4 + 8x^3 - \frac{1}{2} + x$$

$$h(x) = 3x^4 + 2x - \frac{5}{x} + 9x^3 - 7$$

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Q23. Identify the leading coefficient, degree, and end behavior.



1. $f(x) = 5x^2 + 7x - 3$

Degree:

Leading Coeff:

End Behavior:

2. $y = -2x^2 - 3x + 4$

Degree:

Leading Coeff:

End Behavior:

3. $g(x) = x^3 - 9x^2 + 2x + 6$

Degree:

Leading Coeff:

End Behavior:

4. $y = -7x^3 + 3x^2 + 12x - 1$

Degree:

Leading Coeff:

End Behavior:

5. $h(x) = -2x^7 + 5x^4 - 3x$

Degree:

Leading Coeff:

End Behavior:

6. $g(x) = 8x^3 + 4x^2 + 7x^4 - 9x$

Degree:

Leading Coeff:

End Behavior:

Identify the end behavior. Justify your answer.

7. $f(x) = 4x^5 - 3x^4 + 2x^3$

8. $y = -x^4 + x^3 - x^2 + 1 - 1$

9. $h(x) = 3x^6 - 7x^4 - 2x^9$

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Q24. Identify whether the function graphed has an odd or even degree and a positive or negative leading coefficient. Justify your answer.

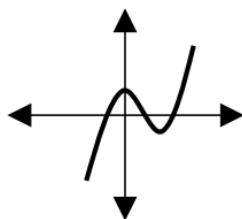


10.

deg:

coeff:

justify:

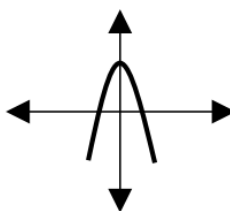


11.

deg:

coeff:

justify:

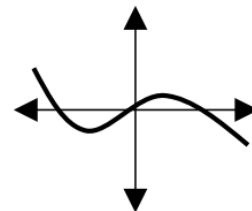


12.

deg:

coeff:

justify:

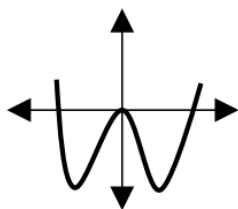


13.

deg:

coeff:

justify:

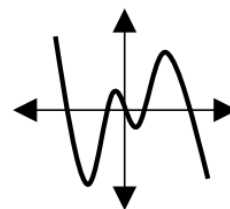


14.

deg:

coeff:

justify:

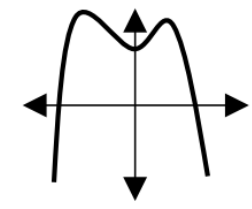


15.

deg:

coeff:

justify:



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Q25. Determine the degree of the polynomial in factored form. Then demonstrate that you are correct by writing the polynomial in standard form.



1. $y = (x + 3)(x^2 - 5x - 4)$

2. $y = x^3(x - 2)^2(x + 1)$

3. $y = x(x + 3)(x - 1)^2$

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Q26. For the functions below, identify each of the listed characteristics



1. $y = (x - 2)(x + 5)(x - 1)$

a) degree & leading coefficient

b) end behavior

c) x -intercepts with multiplicity

d) y -intercept

e) How many distinct x -intercepts?

f) How many roots are there?

2. $f(x) = x^2(x + 2)(x - 7)$

a) degree & leading coefficient

b) end behavior

c) x -intercepts with multiplicity

d) y -intercept

e) How many distinct x -intercepts?

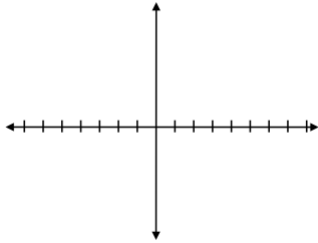
f) How many zeros are there?

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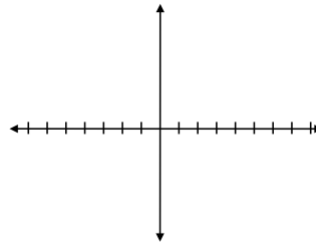


Q27. Sketch graphs of the polynomial functions. Label all x and y intercepts.

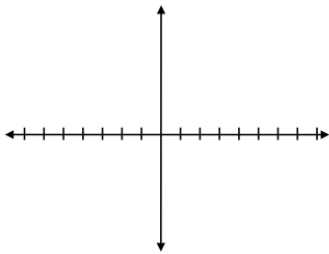
$$y = (x - 1)(x + 3)(x - 4)$$



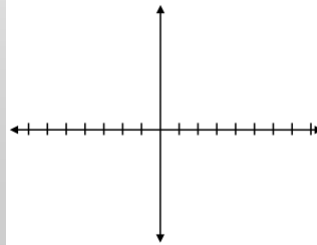
$$g(x) = -x^2(x - 3)$$



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



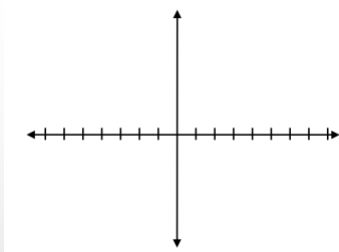
$$f(x) = -3(x + 1)(x + 2)(x - 4)$$



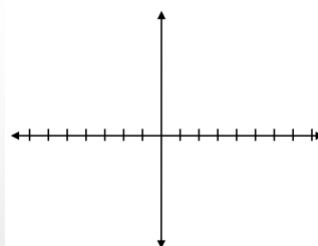
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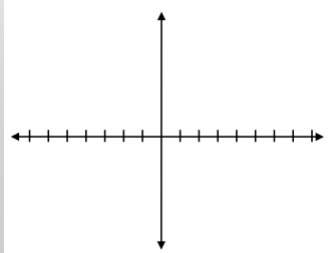
$$y = x^2(x + 5)(x - 3)$$



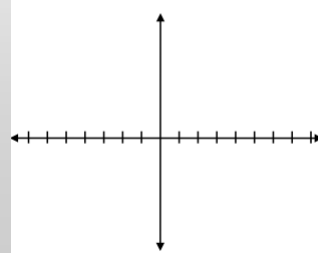
$$h(x) = -(x + 2)(x - 3)^2(x - 1)$$



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

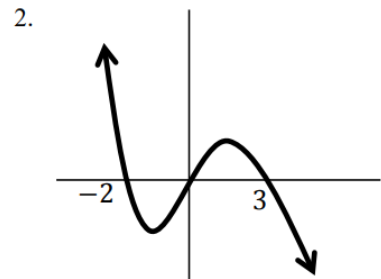
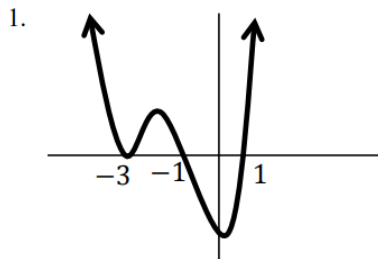


$$g(x) = -5x^2(x + 3)^2$$



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Q28. Write an equation for the polynomial graph shown and determine if the leading coefficient, a , is $+$ or $-$.



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Q29. For the following exercises, find the x- or t- intercepts of the polynomial functions.

1. $C(t) = 2(t - 4)(t + 1)(t - 6)$

2. $C(t) = 3(t + 2)(t - 3)(t + 5)$

3. $C(t) = 4t(t - 2)^2(t + 1)$

4. $C(t) = 2t(t - 3)(t + 1)^2$

5. $f(x) = x^4 - x^2$

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

7. $f(x) = x^3 + 6x^2 - 7x$

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

9. $f(x) = x^3 + 2x^2 - 9x - 18$

10. $f(x) = 2x^3 - x^2 - 8x + 4$

Q30. For the following exercises, find the zeros and give the multiplicity of each.



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

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

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

4. $f(x) = x^2(x^2 + 4x + 4)$

5. $f(x) = (2x + 1)^3(9x^2 - 6x + 1)$

6. $f(x) = (3x + 2)^5(x^2 - 10x + 25)$

7. $f(x) = x(4x^2 - 12x + 9)(x^2 + 8x + 16)$

8. $f(x) = x^6 - x^5 - 2x^4$

9. $f(x) = 3x^4 + 6x^3 + 3x^2$

10. $f(x) = 4x^5 - 12x^4 + 9x^3$

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

12. $f(x) = 4x^4(9x^4 - 12x^3 + 4x^2)$

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Q31. For the following exercises, graph the polynomial functions. Note x-and y-intercepts, multiplicity, and end behavior.



1. $f(x) = (x + 3)^2(x - 2)$
2. $g(x) = (x + 4)(x - 1)^2$
3. $h(x) = (x - 1)^3(x + 3)^2$
4. $k(x) = (x - 3)^3(x - 2)^2$
5. $m(x) = -2x(x - 1)(x + 3)$
6. $n(x) = -3x(x + 2)(x - 4)$

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Q32. For the following exercises, graph the polynomial functions. Note x-and y-intercepts, multiplicity, and end behavior.



1. Degree 3. Zeros at $x = -2$, $x = 1$, and $x = 3$. y-intercept at $(0, -4)$.
2. Degree 3. Zeros at $x = -5$, $x = -2$, and $x = 1$. y-intercept at $(0, 6)$
3. Degree 5. Roots of multiplicity 2 at $x = 3$ and $x = 1$, and a root of multiplicity 1 at $x = -3$. y-intercept at $(0, 9)$
4. Degree 4. Root of multiplicity 2 at $x = 4$, and a roots of multiplicity 1 at $x = 1$ and $x = -2$. y-intercept at $(0, -3)$.
5. Degree 5. Double zero at $x = 1$, and triple zero at $x = 3$. Passes through the point $(2, 15)$.
6. Degree 3. Zeros at $x = 4$, $x = 3$, and $x = 2$. y-intercept at $(0, -24)$.
7. Degree 3. Zeros at $x = -3$, $x = -2$ and $x = 1$. y-intercept at $(0, 12)$.
8. Degree 5. Roots of multiplicity 2 at $x = -3$ and $x = 2$ and a root of multiplicity 1 at $x = -2$. y-intercept at $(0, 4)$.
9. Degree 4. Roots of multiplicity 2 at $x = 12$ and roots of multiplicity 1 at $x = 6$ and $x = -2$. y-intercept at $(0, 18)$.
10. Double zero at $x = -3$ and triple zero at $x = 0$. Passes through the point $(1, 32)$.

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References

- Thomas-Calculus-14th-Edition
- Internet sources

