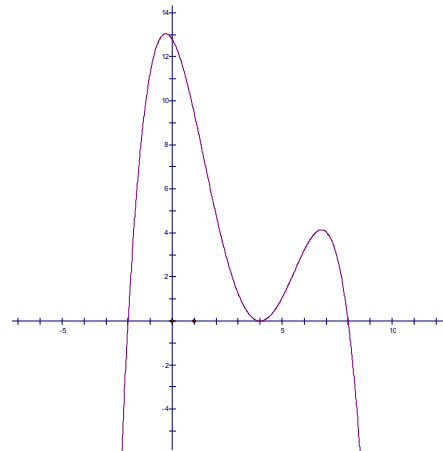
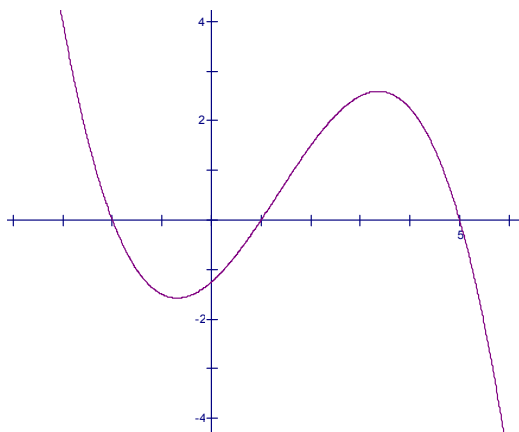


Exam Review

1. For each of the following graphs, state:

- i) the maximum
- ii) the minimum
- iii) the interval(s) where the function is increasing
- iv) the interval(s) where the function is decreasing
- v) the interval(s) where $f(x) > 0$
- vi) the interval(s) where $f(x) < 0$



2. Determine the degree and type of each polynomial function.

a) $f(x) = 4x^3 - 5x + 8$

b) $y = 9x^2 + 5x - 1$

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

d)

| x | y |
|----|----|
| -2 | 11 |
| -1 | 8 |
| 0 | 3 |
| 1 | 2 |
| 2 | 11 |
| 3 | 36 |

e)

| x | y |
|----|-----|
| -2 | -27 |
| -1 | -9 |
| 0 | -7 |
| 1 | -9 |
| 2 | 9 |
| 3 | 83 |

f)

| x | y |
|----|-----|
| -2 | -10 |
| -1 | -1 |
| 0 | 4 |
| 1 | 5 |
| 2 | 2 |
| 3 | -5 |

3. Sketch each of the following.

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

b) $y = 2(x + 2)(x - 1)$

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

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

4. Determine the equation of the specific member of the family of each polynomial function being described.

a) The roots are -1, 8, -3, and it passes through the point (2, -6)

b) The x-intercepts are 3, -4, 0, -1 and it passes through the point (1, 40)

5. Describe the transformations being applied in each of the following cases.

a) $f(x) = -3(x + 1)^4 - 8$

b) $f(x) = (1/2)(x - 4)^4$

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

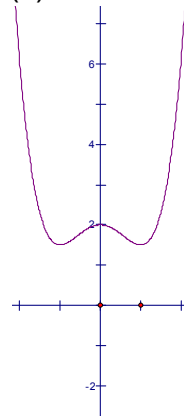
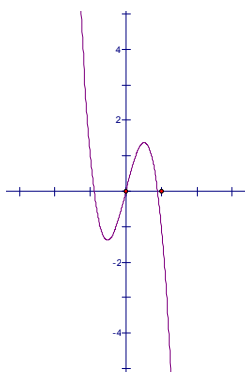
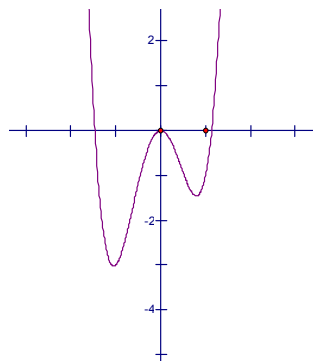
d) $f(x) = 1/3(x + 7)^3$

6. Determine whether each of the following is even, odd or neither. You must justify your answer by discussing all three properties.

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

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

c) $f(x) = 1/2x^4 - x^2 + 2$



7. The model $P(t) = 2t^2 + 3t + 1$ estimates the population of fish in a reservoir, where P represents the population in thousands and t is the number of years since 2000.

a) Find the average rate of population change between 2000 and 2005.

b) Estimate the rate at which the population is changing in 2002. Solve algebraically

8. The gas tank in a parked car holds 75L of gasoline. Gas is leaking from a small hole in the bottom of the tank. The volume, V , of gas remaining in the tank after t minutes can be modeled by $V(t) = 75(1 - t/240)^2$.

- a) How much gasoline remains in the tank after 1h?
- b) What is the average rate of change of volume with respect to time during the first two hours?
- c) How fast is the liquid draining after 3 hours? Solve graphically.
- d) How long does it take for the tank to empty?

9. Divide using long division:

- a) $(x^3 - 3x^2 - 3x + 5) \div (x - 1)$
- b) $(x^4 - 8x^3 + 2x^2 + 24x + 9) \div (x^2 - 2x - 1)$

10. Divide using synthetic division:

- a) $(x^3 - 7x - 6) \div (x - 3)$
- b) $(12x^4 - 56x^3 + 59x^2 + 9x - 18) \div (2x + 1)$

11. Use the remainder theorem to determine the remainder for each of the following:

- a) $(x^3 + 6x^2 - x - 30) \div (x + 5)$
- b) $(x^4 - 5x^2 + 4) \div (x + 2)$

12. Completely factor each of the following:

- a) $x^3 - 3x^2 - 10x + 24$
- b) $x^3 - 7x - 6$
- c) $x^4 + 8x^3 + 4x^2 - 48x$
- d) $3x^3 + 6x^2 - x - 2$

13. Solve for x in each of the following:

- a) $x^3 + 4x^2 - 2x - 18 = x^3 + 3x^2 - x + 2$
- b) $x^3 - 8x^2 - 3x + 90 = 0$
- c) $x^4 - 5x^3 - 17x^2 + 3x + 18 = 0$

14. Solve each polynomial inequality graphically and then graph your solution on a number line.

- a) $x^3 - 6x^2 + 5x + 12 > 0$
- b) $x^4 - 3x^3 - 3x^2 + 7x + 6 \leq 0$

15. Solve each polynomial inequality algebraically and then graph your solution on a number line.

a) $x^3 - 7x - 6 \geq 0$

b) $x^3 - 4x^2 + x + 6 \leq 0$

16. For each function, determine the reciprocal function and then state the vertical and horizontal asymptote of each of the reciprocal functions.

a) $x - 4$

b) $x^2 - 16$

c) $5x - 7$

17. For each function, determine:

i) x-intercept and y-intercept

ii) equation of V.A.

iii) equation of H.A.

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

b) $g(x) = \frac{x^2 + 7x + 6}{x^2 - 4x - 12}$

18. Sketch each of the following rational functions:

a) $y = \frac{2}{x+3}$

b) $y = \frac{x+5}{4x-1}$

19. Solve each of the following rational equations:

a) $\frac{x-2}{x+3} = \frac{x+4}{x-1}$

b) $\frac{2x+3}{x+3} + \frac{1}{2} = \frac{x+1}{x-1}$

20. Suppose that the temperature, T , in degrees Celsius, varies with the height h , in kilometers, above the earth's surface according to the equation $T(h) = \frac{60}{h+2}$. Find the average rate of change of the temperature at the height changes from 1 km to 3 km. Find the instantaneous rate of change of temperature with respect to height at a height of 3 km.

21. A parachutist jumps out of an airplane. The distance, s , (in meters), through which she falls in t seconds is given by $s(t) = 10t - \frac{6t}{t+1}$. Determine the instantaneous rate of change of the distance through which she falls at 3 seconds. Determine the average rate of change of the distance which the parachutist falls from 1 – 2 seconds.

22. Convert each to radian measure:

a) 85°

b) 315°

23. Convert to degree measure:

a) 0.2

b) $\frac{7\pi}{8}$

24. Sketch the graph of each of the following from 0 to 2π

a) $y = \sin x$ b) $y = \cos x$ c) $y = \tan x$ d) $y = \csc x$ e) $y = \sec x$ f) $y = \cot x$

25. For each of the following state:

i) amplitude

ii) period

iii) phase shift

iv) vertical shift

a) $y = \cos(x + \pi/2) - 1$

b) $f(x) = 1/2\sin(3x - \pi)$

26. Sketch one cycle of each graph:

a) $f(x) = 3\cos(4x - \pi)$

b) $y = 1/2\sin 3x - 1$

27. The depth of water at the end of a pier in vacation village varies with the tides throughout the day and can be modeled by the equation $D = 1.5\cos[0.575(t - 3.5)] + 3.8$

a) Determine the average rate of change as t goes from 4.0 to 6.5.

b) Determine the instantaneous rate of change at $t = 6.5$

28. Use special angles to determine the exact value of each of the following trigonometric ratios.

a) $\cos 0.524$

b) $\tan 5\pi/6$

c) $\sin 5.498$

29. Use compound angles to evaluate the exact value of the following:

a) $\sin \pi/12$

b) $\cos 5\pi/12$

30. Prove each trigonometric identity:

a) $\frac{\cot x}{\tan x} = \frac{1 - \sin^2 x}{1 - \cos^2 x}$

b) $\frac{1}{1 + \sin x} + \frac{1}{1 - \sin x} = 2\sec^2 x$

31. Solve each trigonometric equation for $0 \leq x \leq 2\pi$

a) $\sqrt{3} + 2\cos x = 0$

b) $2\cos^2 x + \cos x - 1 = 0$

c) $2\sin^2 x + 5\sin x - 3 = 0$

d) $2\sin x - \cos^2 x = 2$

32. Evaluate each logarithm:

a) $\log_4 \frac{1}{4}$ b) $\log_8 512$ c) $\log_2 8 + \log_3 9$ d) $\log_3 81 - \log_4 64$

33. Write each as a single logarithm:

a) $2\log(x - 1) - \log(3x - 6)$ b) $2\log(2x + 5) + 5\log(x - 8)$

34. Solve using same base:

a) $9^{3x+1} = 27^x$ b) $6(3^{4f-2}) = 2$

35. Solve: $5^{2x-1} = 7$

36. Solve each of the following:

a) $\log_2(x - 2) + \log_2(x + 1) = 2$ b) $\log_5(x + 2) - \log_5(x - 1) = 2\log_5 3$

37. For a biology experiment, there are 50 cells present. After 2 hours, there are 1600 bacteria. How many bacteria would there be in 6 hours?

38. A laboratory has 40 mg of iodine 131. After 24 days, there are only 5 mg remaining. What is the half-life of iodine 131?

39. The population of a fishing village is decreasing by 8%/year. In 1998, there were 4500 people living in the village. Estimate the population in 2004.

40. Compare the intensities of an earthquake of magnitude 7.2 on the Richter scale that occurred in Kobe, Japan, on Jan. 17, 1995, to an earthquake of magnitude 6.9 that occurred in northwest Armenia on Dec. 7, 1988.

41. The noise in the school cafeteria is recorded at 50 dB at 10:00. At 12:00, the noise is found to be 100dB. By what factor does the intensity of the sound increase at lunch?

42. A liquid has pH of 5.62. Find the hydrogen ion concentration $[H^+]$

43. Describe the transformation that takes the graph of the first function to that of the second.

a) $y = \log_4 x$ and $y = \log_4 64x^2$ b) $y = \log_2 x$ and $y = \log_2 128x^{1/2}$

44. Describe the transformations being applied to $f(x) = \log x$:

a) $f(x) = -3\log(-3x + 6) - 1$ b) $f(x) = 1/4\log(-x + 5) - 6$

45. a culture bacteria was serial diluted and spread plated to get the following titer once an hour.

| Hours | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Titer (cells/ml) | 2×10^7 | 2.1×10^7 | 2.3×10^7 | 3.3×10^7 | 6.6×10^7 | 1.4×10^8 | 2.9×10^8 | 6.1×10^8 | 1.1×10^9 | 1.2×10^9 | 1.3×10^9 |

a) Calculate the average rate of growth over the 10 hours of the experiment

b) Calculate the instantaneous rate of growth at hour 5.

46. For each of the following pairs of functions, find:

i) $(f + g)(x)$ ii) $(g - f)(x)$ iii) $(f - g)(x)$ iv) $(fg)(x)$ v) $(f/g)(x)$ vi) $(g/f)(x)$

then state the domain for each combined function

a) $f(x) = -2x + 5$ and $g(x) = 4x - 4$

b) $f(x) = x^2 + 2x + 1$ and $g(x) = 3x^2 + 6$

47. Find an expression for $f(g(x))$ and $g(f(x))$ for each pair of functions and then state each domain.

a) $f(x) = x + 1$ and $g(x) = x^2 - 4$

b) $f(x) = \sqrt{x - 1}$ and $g(x) = x - 2$

c) $f(x) = \frac{1}{x}$ and $g(x) = x + 5$

48. If $f(x) = 3x - 2$ and $g(x) = 2x - 3$, calculate each of the following:

- a) $f(g(1))$ b) $g(f(-1))$ c) $f \circ f(2)$ d) $f \circ f^{-1}(x)$ e) $g^{-1} \circ f(x)$

49. Let $f = \{(3, 1), (5, 2), (7, -2), (9, 6), (11, 0)\}$ and

$$g = \{(1, 3), (-2, 5), (6, 0), (0, 9), (4, 8)\}$$

Evaluate each of the following, if possible.

- a) $f(g(1))$ b) $g(f(7))$ c) $f \circ g(6)$ d) $g \circ f(-1)$

50. The time, T , in seconds, taken for one complete swing of a pendulum is less if the length, L , in centimeters, of the pendulum is shortened. The relationship between T and L is given by $T = 2\pi\sqrt{\frac{L}{980}}$. The length, L , in centimeters, of a pendulum is related to the temperature by the following relationship. $L = w + 0.035C$ where C is the temperature in degrees Celsius and w is the length at 0°C .

- a) Find $T(L(C))$
- b) A pendulum is 100cm in length when the temperature is 0°C . Calculate the period, T , of the pendulum if the temperature is 0°C .
- c) A pendulum is 100cm in length when the temperature is 0°C . Calculate the period, T , of the pendulum if the temperature is 80°C .

Textbook Questions

Pg. 188 # 4, 6, 7, 20, 22 – 28

Pg. 380 # 1 – 3, 5, 8 – 11, 14, 16 – 19, 21, 23 – 26, 29

Pg. 580 # 1, 2, 7, 12 – 14, 16 – 18, 21 – 24, 26, 30, 31