

Fall Final Exam Solutions

1. 35

2. $3x^2 + 6xh + 3h^2 - 4x - 4h - 4$

3. a) -40

b) positive

c) [-50, 50]

d) [-30, 35]

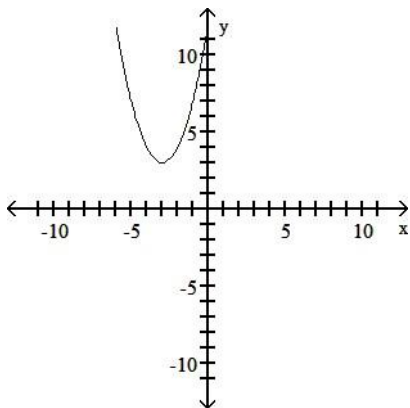
4. a) increasing

b) constant

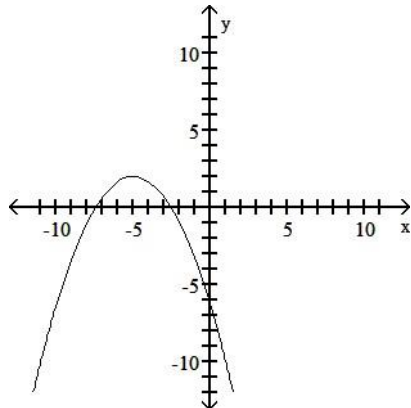
c) decreasing

5. a) $y = x^2 + 6$

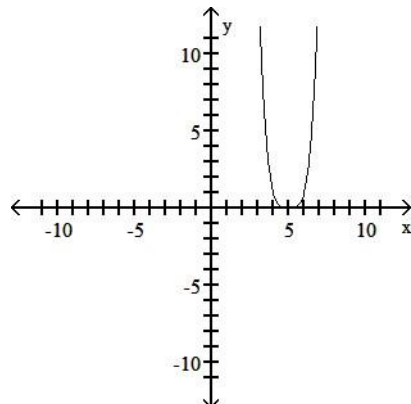
6.



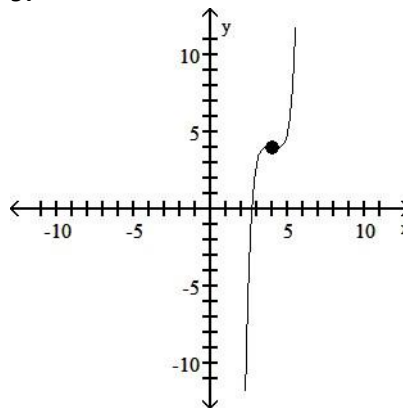
7.



8.



9.



10. $f(x) = x^3 + 2x^2 - 9x - 18$ for $a = 1$

11. $f(x) = x^3 - 4x + 4x^2 - 16$ for $a = 1$

12. -1, multiplicity 1, crosses x-axis; -2, multiplicity 3, crosses x-axis

13. -1, multiplicity 2, touches x-axis

14. Yes

$$\frac{1}{2}$$

15. $\pm \frac{1}{2}, \pm 1, \pm 2, \pm 4, \pm 8$

16. $4 + i$

17. $x = -8, x = 8$

18. $y = x + 10$

19. $(6, \infty)$

20. $(-2, 1)$

21. even

22. neither

23. local maximum at $(0, 6)$

local minimum at $(2.67, -3.48)$

increasing on $(-1, 0)$ and $(2.67, 4)$

decreasing on $(0, 2.67)$

24. $\{x \mid -2 < x < 2\}; (-2, 2)$

25. 3

26. No, no

27. $12x + 1$

28. $f(x) = \frac{5}{\sqrt{x}}; g(x) = 8x + 5$

29. Yes

30. No

31. $178^\circ 31' 48''$

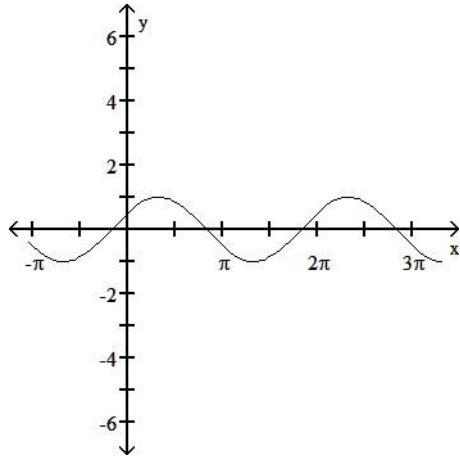
32. 21.29°

33. $\frac{3\pi}{4}$

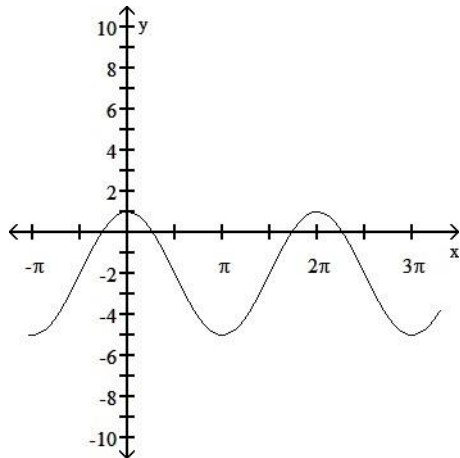
34. 308.57°

35. 209.33 in^2
 36. 11.97 m
 37. $\frac{8\pi}{11} \text{ cm/sec}$
 38. 3.5 radians/sec
 39. $\frac{\sqrt{55}}{8}$
 40. a) 0
 b) 1
 c) -1
 d) $\sqrt{2}$
 e) $\sqrt{2}$
 f) 1
 g) $\frac{1}{2}$
 h) $\frac{2\sqrt{3}}{3}$

41.

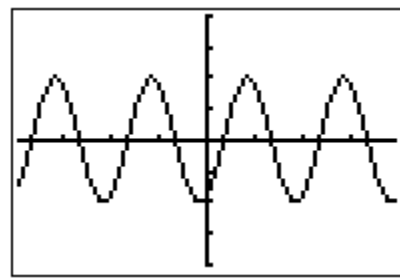


42.

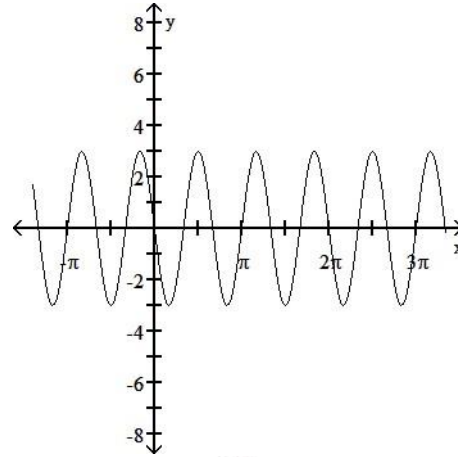


43. (i) $\frac{1}{2}$ (ii) π (iii) π

44.



45.



46. a) $-\sqrt{3}$ b) $\frac{\sqrt{33}}{7}$ c) $-\frac{\pi}{4}$

47. $\left\{ \frac{2\pi}{3}, \frac{4\pi}{3} \right\}$

48. $\left\{ \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3} \right\}$

49. $\left\{ 0, \frac{\pi}{3}, \frac{5\pi}{3} \right\}$

50. $\left\{ \frac{2\pi}{3}, \pi, \frac{4\pi}{3} \right\}$

51. $\left\{ \frac{\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8}, \frac{15\pi}{8} \right\}$

52. $-\frac{120}{169}$

53. $\frac{\sqrt{8+2\sqrt{15}}}{4}$

54. $\sec \theta$

$$\begin{aligned}
 55. \quad & \frac{\sin u}{\cos u} \left(\frac{1}{\sin u} - \frac{\sin^2 u}{\sin u} \right) \\
 &= \frac{\sin u}{\cos u} \left(\frac{\cos^2 u}{\sin u} \right) \\
 &= \cos u
 \end{aligned}$$

$$\begin{aligned}
 56. \quad & (\sin x) \left(\frac{\sin x}{\cos x} \cos x - \frac{\cos x}{\sin x} \cos x \right) \\
 &= \sin^2 x - \cos^2 x \\
 &= 1 - \cos^2 x - \cos^2 x \\
 &= 1 - 2\cos^2 x
 \end{aligned}$$

$$\begin{aligned}
 57. \quad & 1 - \frac{\cos^2 u}{1 - \sin u} \\
 &= \frac{1 - \sin u}{1 - \sin u} - \frac{\cos^2 u}{1 - \sin u} \\
 &= \frac{1 - \sin u - (1 - \sin^2 u)}{1 - \sin u} \\
 &= \frac{\sin^2 u - \sin u}{1 - \sin u} \\
 &= -\sin u \frac{1 - \sin u}{1 - \sin u} \\
 &= -\sin u
 \end{aligned}$$

$$58. \quad d = -6 \cos \left(\frac{2}{3} \pi t \right)$$

$$59. \quad d = -10 \sin \left(\frac{1}{2} \pi t \right)$$

$$60. \quad \text{simple harmonic; } 4 \text{ m; } \frac{2}{5} \pi \text{ sec; } \frac{5}{2\pi} \text{ oscillations/sec}$$

$$61. \quad \text{simple harmonic; } 4 \text{ m; } \frac{2}{3} \pi \text{ sec; } \frac{3}{2\pi} \text{ oscillations/sec}$$