

1. 0.0651

2. 10.8 minutes

3. $x^4 + 12x^3 + 54x^2 + 108x + 81$

4. $\frac{-2\sqrt{10}}{3}$

5. $\sin\left(4\pi x - \frac{\pi}{6}\right)$

6. $f(x) = -2x^3 - 6x^2 + 8$

6A. $-2 < x < 1$

6B. $x = -2 \cup [1, \infty)$

6C. Neither

7. $\theta = 138^\circ, 222^\circ$

8. $\frac{1}{4}$

9. A. $2\sqrt{26}$

B. $x^2 + 2x + y^2 - 6y = 16$

10. A. Suppose $x = c$ (critical point) of $f(x)$ then,

If $f'(x) > 0$ to the left of $x = c$ and $f'(x) < 0$ to the right of $x = c$ is a local maximum.

If $f'(x) < 0$ to the left of $x = c$ and $f'(x) > 0$ to the right of $x = c$ is a local minimum.

If $f'(x)$ is the same sign on both sides of $x = c$ then $x = c$ is neither local maximum nor local minimum. Critical point $x = 5/3$

Minimum $(5/3, 2)$

$$\text{B. } |5 - 3x| + 2 \leq 6$$

$$|5 - 3x| + 2 - 2 \leq 6 - 2$$

$$|5 - 3x| \leq 6 - 2$$

$$|5 - 3x| + \leq 4$$

$$-4 \leq |5 - 3x| + \leq 4$$

$$5 - 3x \leq 4 \quad 5 - 3x \geq -4$$

$$x \geq 1/3 \quad x \leq 3$$

$$1/3 \leq x \leq 3$$

$$11. \tan\left(2x + \frac{\pi}{6}\right) = -\sqrt{3}$$

$$\left(2x + \frac{\pi}{6}\right) = \tan^{-1} - \sqrt{3}$$

$$\left(2x + \frac{\pi}{6}\right) = -60$$

$$\left(2x + \frac{\pi}{6}\right) = \frac{2\pi}{3}$$

$$2x = \frac{2\pi}{3} - \frac{\pi}{6}$$

$$x = \frac{\pi}{2}$$

$$\left(2x + \frac{\pi}{6}\right) = \frac{5\pi}{6}$$

$$2x = \frac{5\pi}{6} - \frac{\pi}{6}$$

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

$$x = \frac{2\pi}{3}, \frac{\pi}{2}, \frac{5\pi}{3}, \frac{3\pi}{2}$$

12. A. v (-10,12) w (4,-3)

$$v = -10i + 12j \quad w = 4i - 3j$$

$$v \cdot w = -10(4) + 12(-3)$$

$$v \cdot w = -40 - 36 = -76$$

$$B. \cos\theta = \frac{v \cdot w}{|v||w|}$$

$$|v| = \sqrt{(-10)^2 + 12^2} = 15.62$$

$$|w| = \sqrt{(4)^2 + (-3)^2} = 5$$

$$\cos\theta = \frac{-76}{15.62 \times 5} = -0.9731$$

$$\theta = 166.68$$

13.

$$\sqrt{2}(\cos x)(\sin x) + \sin x = 0$$

$$\sin x(\sqrt{2}(\cos x) + 1) = 0$$

$$\sin x = 0 \quad x = 180, 360$$

$$(\sqrt{2}(\cos x) + 1) = 0$$

$$(\cos x) = -0.7071$$

$$x = 135, 225, 315$$

$$x = 135, 180, 225, 315, 360$$

$$14. A. \sec(-\alpha) = \sec(\alpha) = \frac{1}{\frac{1}{\sqrt{10}}} = \sqrt{10}$$

$$B. \tan 2x = \frac{2 \tan x}{1 - \tan^2 x} = \frac{2 \times 3}{1 - 3^2} = \frac{6}{1 - 9} = \frac{6}{-8} = -0.75$$

$$C. \sin(\pi/2 - \alpha) = \tan(\pi/2 - \alpha) \times \cos(\pi/2 - \alpha)$$

$$\sin(\pi/2 - \alpha) = \frac{1}{3} \times \frac{3}{\sqrt{10}} = \frac{1}{\sqrt{10}} = \frac{\sqrt{10}}{10}$$

$$15. M = (1000 + 100)/(-20 - 60)$$

$$M = 1100/-80 = 110/8$$

$$(y + 100)/(x - 60) = 110/8$$

$$8(y + 100) = 110(x - 60)$$

$$8y + 800 = 110x - 6600$$

$$8y = 110x - 6600 - 800$$

$$8y = 110x - 7400$$

$$y = 110x/8 - 925$$

$$16. \frac{1^{x+2}}{2} = 9$$

$$(x + 2) \log 0.5 = \log 9$$

$$x + 2 = 3.1699$$

$$x = 3.1699 - 2$$

$$x = 1.1699$$

$$17. \sin^2 \frac{\theta}{2} = \frac{\sin \theta - \tan \theta}{-2 \tan \theta}$$

$$\frac{\sin\theta - \tan\theta}{-2\tan\theta} = \frac{\tan\theta - \sin\theta}{2\tan\theta}$$

18. Directrix $x = 1$, focus $(-3,1)$

Vertex $(-1,1)$ $p = 2$

$$(y - k)^2 = 4p (x - h)$$

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

$$y^2 - 2y + 1 = 8x + 8$$

$$y^2 - 2y + 1 - 8 = 8x$$

$$y^2 - 2y - 7 = 8x$$

$$x = \frac{1}{8}(y^2 - 2y - 7)$$

19. $a^2 = b^2 + c^2 - 2cb\cos A$

$$12^2 = 24^2 + 16^2 - 2 \times 16 \times 24\cos A$$

$$144 = 576 + 256 - 768\cos A$$

$$768\cos A = 688$$

$$\cos A = 0.8958$$

$$A = 26.4^\circ$$

$$b^2 = a^2 + c^2 - 2ab\cos B$$

$$24^2 = 12^2 + 16^2 - 2 \times 16 \times 12\cos B$$

$$576 = 144 + 256 - 384\cos B$$

$$384\cos B = -176$$

$$\cos B = -0.4583$$

$$B = 117.3^\circ$$

$$C = (180 - (117.3 + 26.4)) = 36.3^\circ$$

$$\text{Area} = 0.5ab\sin\theta = 0.5 \times 12 \times 24 \times \sin 36.3^\circ = 85.2 \text{ square units}$$

20. A. $g(x) = \frac{1-9x^2}{x^2-4x}$

Vertical asymptote denominator = 0

$$x^2 - 4x = 0$$

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

$$x = 0, 4$$

B. $\frac{1-9x^2}{x^2-4x} \leq 0$

$$\frac{(3x+1)(3x-1)}{x(x-4)} \leq 0$$

$$3x + 1 = 0 \quad 3x - 1 = 0 \quad x(x - 4) = 0$$

$$x = -1/3, 1/3, 0, 4$$

$$x \leq -1/3 \text{ or } 0 < x \leq 1/3 \text{ or } x > 4$$

21. Focus (-7,2) vertices (-4,2), (8,2)

$$\text{Center} = (-4 + 8)/2, (2 + 2)/2 = (2,2)$$

$$a = 6 \quad a^2 = 36$$

$$c = 9 \quad c^2 = 81$$

$$b^2 = 81 - 36 = 45$$

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2}$$

$$\frac{(x-2)^2}{36} - \frac{(y-2)^2}{45}$$

22. A. $V = 0$

$$V = -32t + 120$$

$$0 = -32t + 120$$

$$32t = 120$$

$$t = 3.75 \text{ seconds}$$

$$\text{B. } h(t) = -16t^2 + 120t + 2$$

$$h(t) = -16(3.75)^2 + 120 \times 3.75 + 2 = 227 \text{ feet}$$

23.

$$\frac{x-5}{x-4} + \frac{8}{x^2-16} = 0$$

$$\frac{(x+4)(x-5)+8}{x^2-16} = 0$$

$$x^2 - x - 12 = x^2 - 16$$

$$-x - 12 = -16$$

$$x + 12 = 16$$

$$x = 16 - 12$$

$$x = 4$$

24. A. horizontal $x = -7, 10$

Domain = $[-7, 10]$ interval notation $-7 \leq x \leq 10$

Range vertical $y = 12, 0 = [0, 12]$ interval notation $0 \leq y \leq 12$

B. From the graph

$$x = 5$$

C. $x = 5$, from graph.

$$25. 9y^2 + 10x^2 - 40x = 50$$

$$10x^2 - 40x + 9y^2 = 50$$

$$10(x^2 - 4x + 4) + 9y^2 = 50 + 40$$

$$10(x-2)^2 + 9(y+0)^2 = 90$$

$$\frac{(x-2)^2}{9} - \frac{(y+0)^2}{10} = 1$$

$$\text{Center} = (2, 0)$$

$$a^2 - b^2 = c^2$$

$$10 - 9 = c^2$$

$$c^2 = 1$$

$$c = \pm 1$$

$$\text{foci} = (2, 1), (2, -1)$$

$$b^2 = 9$$

$$b = 3$$

$$\text{endpoints } (2, 0+3), (2, 0-3)$$

$$(2, 3), (2, -3)$$

