

## Solutions to Selected Problems



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**0.1. Section 1.1****Problem 20**

$$\frac{4}{3}\pi(3r^2 + 3r + 1)$$

**Problem 21**

$$1 - 2x - h$$

**Problem 23**

$$(-\infty, 1/3) \cup (1/3, \infty)$$

**Problem 20**

$$\text{domain } [-2, 2] \quad \text{range } [0, 2]$$

**Problem 33**

$$f(x) = \begin{cases} 2x + 3 & \text{if } x < -1 \\ 3 - x & \text{if } x \geq -1 \end{cases}$$

Domain is  $R$ .**Problem 47**

$$S(x) = x^2 + \frac{8}{x} \quad \text{with domain } x > 0$$

**0.2. Section 1.2****Problem 11**

$$a) P = 0.434d + 15 \quad b) d = 195.85ft$$

**Problem 13**

$$a) f(x) = a \cos(bx) + c \quad b) f(x) = mx + b$$

**0.3. Section 1.3****Problem 10** Start with  $y = \cos x$ , reflect about  $x$ -axis, shift 2 units upward.**Problem 35**

$$(f \circ g)(x) = \sin(1 - \sqrt{x}), \quad D = [0, \infty)$$

$$(g \circ f)(x) = \sin(1 - \sqrt{\sin x}), \quad D = \{x | x \in [2n\pi, \pi + 2n\pi], n \text{ an integer}\}$$

$$(f \circ f)(x) = \sin(\sin x), \quad D = R$$

$$(g \circ g)(x) = 1 - \sqrt{1 - \sqrt{x}}, \quad D = [0, 1]$$

**Problem 41**

$$g(x) = x^2 + 1 \quad f(x) = x^{10}$$

**0.4. Section 1.5****Problem 15**

$$f(x) = 3 \cdot 2^x$$

**Problem 17**

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

**0.5. Section 1.6****Problem 3** Not 1:1**Problem 5** 1:1**Problem 6** Not 1:1**Problem 10** Not 1:1**Problem 36** a) 2 b)  $\sqrt{2}$ **Problem 38** a) 15 b) 8**0.6. Section 1.7**

**Problem 15** The particle moves along the lower half of the circle  $x^2 + y^2 = 1$  counterclockwise from  $(-1, 0)$  to  $(1, 0)$ .

**Problem 17** The particle moves clockwise once around the ellipse  $x^2/4 + y^2/9 = 1$  starting at  $(0, 3)$ .

**0.7. Section 2.1****Problem 5** a) At  $t = 2$ ,  $y = 16$  b)  $-24\text{ft/s}$ **Problem 5** a)  $t = 1$ , Avg velocity =  $56.34 - 0.83h$  b)  $56.34\text{m/s}$ **0.8. Section 2.2****Problem 3** a) 2 b) 3 c) does not exist d) 4 e) does not exist**Problem 5** a)  $-1$  b)  $-2$  c) does not exist d) 2 e) 0 f) does not exist g) 1 h) 3**0.9. Section 2.3****Problem 1** a) 5 b) 9 c) 2 d)  $-1/3$  e)  $-3/8$  f) 0 g) does not exist**Problem 3** 75**Problem 4**  $3/4$ **Problem 5** -3

**Problem 6** 4

**Problem 9** 5

**Problem 10**  $3/5$

**Problem 16** 32

**Problem 19**  $-1/16$

**Problem 25** 1

**Problem 29** 0

**Problem 30** does not exist

**Problem 33a** i) 0 ii) 0 iii) 1 iv) 1 v) 0 vi) does not exist

**Problem 34** a-i) 2 a-ii)  $-2$  b) does not exist

**Problem 43**  $a = 15$ ;  $\lim_{x \rightarrow -2} = -1$

#### 0.10. Section 2.4

**Problem 1**  $f(4)$

**Problem 4**

$$[-4, -2) \cup (-2, 2) \cup [2, 4) \cup (4, 6) \cup (6, 8)$$

**Problem 17**

$$(-\infty, 3) \cup (-3, -2) \cup (-2, \infty)$$

**Problem 18**

$$[-5, 5]$$

**Problem 19**

$$(-\infty, \infty)$$

**Problem 25**

$$\lim_{x \rightarrow 4} f(x) = f(4) = 7/3$$

**Problem 26**

$$0$$

**Problem 31**

$$c = 1/3$$

**0.11. Section 2.5****Problem 3**

$$a) \infty b) \infty c) -\infty d) 1 e) 2 f) Vx = -1, 2 \quad Hy = 1, 2$$

**Problem 5**

$$f(0) = 0 \quad f(1) = 1 \quad \lim_{x \rightarrow \infty} f(x) = 0; \text{ f is odd.}$$

**Problem 13**

$$-\infty$$

**Problem 14**

$$-\infty$$

**Problem 15**

$$\infty$$

**Problem 16**

$$-\infty$$

**Problem 19**

$$1/2$$

**Problem 20**

$$0$$

**Problem 25** does not exist

**Problem 42**

$$m \rightarrow \infty$$

**Problem 43**

$$a) \quad C(t) = \frac{30t}{200+t} g/L \quad b) 30$$

**0.12. Section 2.6****Problem 13**

$$a) 0 \quad b) \text{ faster at } C \quad d) \text{ did not move}$$

**Problem 15**

$$-24ft/s$$

**Problem 21**

$$a - i) - 1.2a - ii) - 1.25a - iii) - 1.3b) - 1.9$$

**0.13. Section 2.7****Problem 1**

$$\text{slope} = \frac{f(2+h) - f(2)}{h}$$

**Problem 3**

$$g'(0) < 0 < g'(4) < g'(2) < g'(-2)$$

**Problem 4**

$$f'(4) = 1/4$$

**Problem 13**

$$-2 + 8a$$

**Problem 15**

$$\frac{5}{(a+3)^2}$$

**Problem 19**

$$\lim_{h \rightarrow 0} \frac{(1+h)^{10} - 1}{h}$$

**Problem 20**

$$\lim_{h \rightarrow 0} \frac{\sqrt[4]{16+h} - 2}{h}$$

**Problem 21**

$$\lim_{x \rightarrow 5} \frac{2^x - 32}{x - 5}$$

**Problem 25**

$$-2m/s$$

**0.14. Section 2.8****Problem 19**

$$-7$$

**Problem 21**

$$-3$$

**Problem 25**

$$\frac{4}{(t+1)^2}$$

**Problem 28a**

$$\frac{-12t}{(1+t^2)^2}$$

**Problem 31** Not differentiable at  $x = -1, 11, 4, 8$

**0.15. Section 2.10**

**Problem 1a** increasing on  $(1, 5)$ ; decreasing on  $(0, 1) \cup (5, 6)$ .

**Problem 2a** increasing on  $(0, 1) \cup (3, 5)$ ; decreasing on  $(1, 3) \cup (5, 6)$

**Problem 13** always decreasing; concave downward

**Problem 14** always decreasing; concave upwa

**Problem 21** increasing on  $(0, \infty)$ ; decreasing on  $(-\infty, 0)$ .

**Problem 23**

- a) increasing on  $(-\infty, -\sqrt{1/3}) \cup (\sqrt{1/3}, \infty)$ ; decreasing on  $(-\sqrt{1/3}, \sqrt{1/3})$
- b) *CUon*  $(0, \infty)$ ; *CDon*  $(-\infty, 0)$
- c) inflection point at  $(0, 0)$

**Problem 24**

- a)  $f'(x) = x^3 - 4x$   $f''(x) = 12x^2 - 4$
- b) increasing on  $(-1, 0) \cup (1, \infty)$ ; decreasing on  $(-\infty, -1) \cup (0, 1)$
- c) *CUon*  $(-\infty, -\sqrt{1/3}) \cup (\sqrt{1/3}, \infty)$ ; *CDon*  $(-\sqrt{1/3}, \sqrt{1/3})$