

ANSWERS

CHAPTER 8

- (1) $x = \pm \frac{5}{3}$
- (2) $x = \frac{7 \pm 2\sqrt{7}}{8}$
- (3) $x = \frac{1 \pm \sqrt{3}}{2}$
- (4) $t = 2 \pm \frac{\sqrt{14}}{3} i$
- (5) $y = 1 \pm \sqrt{3} i$
- (6) $x = \frac{-1}{3} \pm \frac{1}{9} i$
- (7) $x = 1$ or $x = 7$
- (8) $x = \frac{3 \pm \sqrt{19}}{2}$
- (9) $x = \frac{-13}{2}$ or $x = \frac{-5}{2}$
- (10) $x = \frac{5 \pm \sqrt{277}}{6}$
- (11) $x = \frac{-3}{7}$ or $x = \frac{-1}{7}$
- (12) $x = \frac{-2 \pm 3\sqrt{5}}{3}$
- (13) $x = \frac{2 \pm \sqrt{2}}{2}$
- (14) $x = \frac{1 \pm i\sqrt{15}}{4}$
- (15) $x = 1$ or $x = 2$

- (16) (a) $x^2 - 2x - 1 = 0$
- (b) $x^2 - x - 6 = 0$
- (c) $x^2 - 2x + 5 = 0$
- (d) $21x^2 + 22x - 8 = 0$
- (17) (a) $y = \frac{-x \pm \sqrt{8 - 11x^2}}{2}$
- (b) $w = \frac{-2d \pm \sqrt{4e^2 + 2A}}{2}$
- (c) $b = \pm \sqrt{c^2 - a^2}$
- (d) $t = \frac{23 \pm \sqrt{529 - 576k}}{96}$
- (e) $v = \pm \sqrt{2gh}$
- (f) $d = \pm \sqrt{\frac{sl}{kw}} = \pm \frac{\sqrt{slkw}}{kw}$
- (18) (a) $x = \pm 1$ or $x = \pm \sqrt{2}$
- (b) $x = -1$ or $x = 27$
- (c) $x = 4$
- (19) (a) $x = \frac{-2}{3}$ or $x = 7$
- (b) $p = \frac{5 \pm \sqrt{25 - 4m^2}}{2m}$
- (c) $x = \frac{-1 \pm \sqrt{21}}{2}$

(d) $x = -\frac{1}{3}$ or $x = \frac{5}{2}$

(e) $x = -2\sqrt{2}$ or $x = \frac{\sqrt{2}}{2}$

(f) $x = -3$ or $x = 1$ or $x = -1 \pm i\sqrt{2}$

(g) $x \in \mathbb{R}$

(h) $y \leq \frac{25}{8}$

(i) no

(20) (a) parabola opening up

(b) (0, 1)

(c) V(-3, -2)

(d) $(-3 \pm \frac{\sqrt{6}}{3}, 0)$

(f) $y = \frac{x^2}{3} + 2x + 1$

(g) $x \in \mathbb{R}$

(h) $y \geq -2$

(i) The function is not one-to-one because its graph doesn't pass the horizontal line test. There for, it doesn't have an inverse.

(21) (i) (a) parabola opening down

(b) (0, 3)

(c) $(\frac{1}{4}, \frac{25}{8})$

(d) (-1, 0) and $(\frac{3}{2}, 0)$

(f) $y = -2(x - \frac{1}{4})^2 + \frac{25}{8}$

(21ii) (a) parabola opening down

(b) (0, 1)

(c) $(-\frac{1}{10}, \frac{11}{10})$

(d) $(\frac{-1 \pm \sqrt{11}}{10}, 0)$

(f) $y = -10(x + \frac{1}{10})^2 + \frac{11}{10}$

(g) $x \in \mathbb{R}$

(h) $y \leq \frac{11}{10}$

(i) no

(21iii) (a) parabola opening up

(b) (0, 66)

(c) (28, -46)

(d) $(28 \pm \sqrt{322}, 0)$

(f) $y = \frac{1}{7}(x - 28)^2 - 46$

(g) $x \in \mathbb{R}$

(h) $y \leq -46$

(i) no

(22) (a) $h(0) = 12.25$ m
initial height

(b) $h(t) = 0$ when $t \approx 2$ sec
it hits the ground
after approx. 2 seconds.

(c) $h(t) = 16$ has no real
solutions, so the rocket
will never reach that
height

(23) $h > 40$ when $t \in (1, 2.5)$
between 1 sec and 2.5 sec.

(24) (a) $x \in [-1, 7]$

(b) $x \in [3 - \sqrt{2}, 3 + \sqrt{2}]$

(c) $x \in (-\infty, 0] \cup [\frac{2}{3}, 3]$

(d) $x \in (-\infty, -\frac{2}{2}) \cup (-3, 2)$

(e) $x \in (-\infty, -3) \cup (-2, 0)$

(28) (a) after 16 years, in 2013

(b) after 18.6 years, in 2015

(1) (a) $x < 3$

(b) $x \in (-\infty, -5) \cup (5, \infty)$

(c) $x \in (-2, \frac{3}{4})$

(2) (a) 1 (b) 0 (c) 0

(3) (a) 3 (b) -2 (c) -3

(d) $\frac{1}{2}$ (e) 1 (f) 0

(g) 0 (h) 1 (i) 0

(j) 2 (k) 1 (l) $5A^2$

(m) $2ab$

(4) (a) $\log_3 4 + \log_3 p - \log_3 q$

(b) $1 + \frac{1}{2} \log_5 7 - \log_5 3$

(c) cannot be expanded

(d) $\frac{1}{2} \log_m 5 + \frac{3}{2} \log_m r - \frac{5}{2} \log_m z$

(e) $\frac{1}{2} \log_3 x + \frac{1}{3} \log_3 y - 2 \log_3 w$

$- \frac{1}{2} \log_3 z$

(f) $\ln 5 + \ln x + \frac{1}{2} \ln(1+3x) -$
 $- 3 \ln(x-4)$

(5) (a) $\log_a \frac{xy}{m}$

(b) $\log_m \frac{a^2}{b^6}$

(c) $\log_b \frac{2y+5}{\sqrt{y+3}}$

(6) (a) $(g \circ f)(x) = \frac{1+2x}{4-2x}$

(b) $(f \circ g)(2) = 1$

(c) $f^{-1}(x) = \frac{1+x}{2}$

(d) $g^{-1}(x) = \frac{2-3x}{1+x}$

(7) (a) $\ln \frac{x^4 y^7}{z^3}$

(b) $\log_5 \frac{\sqrt{x^4}}{(x+1)^2}$

(c) 5 (d) 1

(9) (a) $x \in \mathbb{R}$

(b) $y > 0$

(c) (0,1)

(d) none

(e) H.A. $y=0$

(f) yes, its graph passes the horizontal line test

(2) Yes, it's one-to-one
(h) $f^{-1}(x) = \log_4 x$

(10a) (a) $x > 0$
(b) $y \in \mathbb{R}$

(c) none

(d) (1,0)

(e) V.A. $x=0$

(h) $f^{-1}(x) = 2^x$

(10b) (a) $x > 0$
(b) $y \in \mathbb{R}$

(c) none

(d) (1,0)

(e) V.A. $x=0$

(h) $g^{-1}(x) = e^x$

(11) (a) 1 (b) -6

(12) (a) $x = \frac{26}{3}$

(b) $x=17$

(c) $x = \log_4 20 = \frac{\ln 20}{\ln 4} \approx 2.16$

(d) $x = \frac{49}{25}$

(e) $x = \frac{\ln 6}{0.6} \approx 2.99$

(f) $x=13$

Chapter 10

(1) Center $(-\frac{3}{4}, \frac{1}{4})$, radius = $\frac{\sqrt{16}}{4}$

(2) (a) $d = \sqrt{106}$
 (b) $(-\frac{7}{2}, -\frac{9}{2})$

(3) (a) $(x-5)^2 + (y+6)^2 = 100$

(b) x-axis: $(13, 0)$ and $(-3, 0)$
 y-axis: $(0, -6-5\sqrt{3})$ and $(0, -6+5\sqrt{3})$

(4) (b) $(0, 0)$
 (c) horizontal, 8
 (d) vertical, 6
 (e) $(4, 0)$ and $(-4, 0)$
 (f) $(\sqrt{7}, 0)$ and $(-\sqrt{7}, 0)$

(5) (b) $(\frac{5\sqrt{5}}{\sqrt{21}}, \frac{8}{\sqrt{21}})$
 $(\frac{5\sqrt{5}}{\sqrt{21}}, -\frac{8}{\sqrt{21}})$, $(-\frac{5\sqrt{5}}{\sqrt{21}}, \frac{8}{\sqrt{21}})$
 $(-\frac{5\sqrt{5}}{\sqrt{21}}, -\frac{8}{\sqrt{21}})$

(6) Center $(-3, -1)$
 radius = 2
 x-axis: $(-3+\sqrt{3}, 0)$ and $(-3-\sqrt{3}, 0)$
 y-axis: none

(7) parabola opening to the right

V $(-1, 3)$

x-axis: $(8, 0)$

y-axis: $(2, 0)$ and $(4, 0)$

(8) hyperbola with non focal transverse center $(0, 0)$

vertices $(2, 0)$ and $(-2, 0)$

foci $(\sqrt{13}, 0)$ and $(-\sqrt{13}, 0)$

asymptotes: $y = \pm \frac{3}{2}x$

Chapter 11

(1) (a) $(x+y)^7 = x^7 + 7x^6y + 21x^5y^2 + 35x^4y^3 + 35x^3y^4 + 21x^2y^5 + 7xy^6 + y^7$

(b) $(a+2b)^4 = a^4 + 8a^3b + 24a^2b^2 + 32ab^3 + 16b^4$

(c) $(2x-1)^5 = 32x^5 - 80x^4 + 80x^3 - 40x^2 + 10x - 1$

(2) (a) $4! = 1 \cdot 2 \cdot 3 \cdot 4 = 24$

(b) $\frac{1}{16 \cdot 17 \cdot 18} = \frac{1}{4896}$

(c) $\frac{8 \cdot 7 \cdot 6}{1 \cdot 2 \cdot 3} = 56$

$$(d) \quad {}_{10}C_6 = {}_{10}C_4 = \frac{10 \cdot 9 \cdot 8 \cdot 7}{1 \cdot 2 \cdot 3 \cdot 4} = 210$$

$$(3) \quad (a) \quad a_1 = 5 \text{ - given}$$

$$a_2 = 13$$

$$a_3 = 37$$

$$a_4 = 109$$

$$(b) \quad a_1 = 1 \text{ given}$$

$$a_2 = -4$$

$$a_3 = -14$$

$$a_4 = -34$$

$$(c) \quad a_1 = 1$$

$$a_2 = 8$$

$$a_3 = \frac{27}{2}$$

$$a_4 = \frac{32}{3}$$

$$(4) \quad (a) \quad a_n = \frac{n}{n+1}$$

$$a_{52} = \frac{52}{53}$$

$$(b) \quad a_n = 2^n (-1)^{n-1}$$

$$(5) \quad (a) \quad \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} = \frac{57}{60}$$

$$(b) \quad 1 + 2x + 3x^2 + 4x^3$$

$$(c) \quad 2 \cdot 3 + 3 \cdot 4 + 4 \cdot 5 = 37$$

$$(d) \quad \binom{5}{0} + \binom{5}{1} + \binom{5}{2} + \binom{5}{3} + \binom{5}{4} + \binom{5}{5}$$

$$= 1 + 5 + \frac{5 \cdot 4}{1 \cdot 2} + 10 + 5 + 1$$

$$= 32$$

$$(6) \quad \text{note that } a_n = \frac{n}{n+1}$$

$$\sum_{n=1}^{14} \frac{n}{n+1}$$