Solutions Manual

Algebra 2

An Incremental Development

THIRD EDITION

SAXON

Algebra 2

Solutions Manual

Third Edition

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Preface

This manual contains solutions to every problem in the third edition of John Saxon's *Algebra 2* textbook. The solutions are designed to be representative of students' work, but please keep in mind that many problems will have more than one correct solution. We have attempted to stay as close as possible to the methods and procedures outlined in the textbook. Early solutions of problems of a particular type contain every step. Later solutions omit simpler steps. The final answers are set in boldface for ease of grading.

Problem Set A

1. $y + 65 = 180$
$y = 180 - 65 = \mathbf{115}$

2. $x + 40 = 90$
$x = 90 - 40 = \mathbf{50}$

3. $x + 89 = 180$
$x = 180 - 89$
$x = \mathbf{91}$

Since vertical angles are equal,
$y = \mathbf{89}$

$p = \mathbf{91}$

4. $z + 100 = 180$
$z = 180 - 100 = \mathbf{80}$

Since vertical angles are equal,
$2x = 80$
$x = \mathbf{40}$

$4y = 100$
$y = \mathbf{25}$

5. Angle + Supplement = 180°
Angle + 40° = 180°
Angle = 180° − 40°
Angle = **140°**

6. Angle + Complement = 90°
Angle + 40° = 90°
Angle = 90° − 40°
Angle = **50°**

7. $-2 - (-2) = -2 + 2 = \mathbf{0}$

8. $-3 - [-(-2)] = -3 - 2 = \mathbf{-5}$

9. $-2 - 3(-2 - 2) - 5(-5 + 7)$
$= -2 - 3(-4) - 5(2)$
$= -2 - (-12) - (10)$
$= -2 + 12 - 10 = \mathbf{0}$

10. $-[-2(-5 + 2) - (-2 - 3)]$
$= -[-2(-3) - (-5)]$
$= -[6 + 5] = \mathbf{-11}$

11. $-2 + (-2)^3 = -2 + (-8)$
$= -2 - 8 = \mathbf{-10}$

12. $-3^2 - 3 - (-3)^2$
$= -9 - 3 - 9 = \mathbf{-21}$

13. $-3(-2 - 3 + 6) - [-5(-2) + 3(-2 - 4)]$
$= -3(1) - [-5(-2) + 3(-6)]$
$= -3 - [10 - 18] = -3 - [-8] = \mathbf{5}$

14. $-2 - 2^2 - 2^3 - 2^4$
$= -2 - 4 - 8 - 16 = \mathbf{-30}$

15. $|-2| - |-4 - 2| + |8| = |-2| - |-6| + |8|$
$= 2 - 6 + 8 = \mathbf{4}$

16. $-|-3(2) - 3| - 2^2 = -|-6 - 3| - 4$
$= -|-9| - 4 = -9 - 4 = \mathbf{-13}$

17. $-2^2 - 2^3 - |-2| - 2 = -4 - 8 - 2 - 2$
$= \mathbf{-16}$

18. $-3[-1 - 2(-1 - 1)][-3(-2) - 1]$
$= -3[-1 - 2(-2)][6 - 1] = -3[-1 + 4][6 - 1]$
$= -3[3][5] = \mathbf{-45}$

19. $-3[-3(-4 - 1) - (-3 - 4)]$
$= -3[-3(-5) - (-7)]$
$= -3[15 + 7] = -3[22] = \mathbf{-66}$

20. $-2[(-3 + 1) - (-2 - 2)(-1 + 3)]$
$= -2[(-2) - (-4)(2)] = -2[-2 + 8]$
$= -2[6] = \mathbf{-12}$

21. $-2[-2(-4) - 2^3](-|2|) = -2[8 - 8](-2)$
$= -2[0](-2) = \mathbf{0}$

22. $-8 - 3^2 - (-2)^2 - 3(-2) + 2$
$= -8 - 9 - 4 + 6 + 2 = \mathbf{-13}$

23. $-\{-[-5(-3 + 2)7]\} = -\{-[-5(-1)7]\}$
$= -\{-[35]\} = \mathbf{35}$

24. $-5 - |-3 - 4| - (3)^2 - 3$
$= -5 - |-7| - 9 - 3$
$= -5 - 7 - 9 - 3 = \mathbf{-24}$

25. $3(-2 + 5) - 2^2(2 - 3) - |-2|$
$= 3(3) - 4(-1) - 2$
$= 9 + 4 - 2 = \mathbf{11}$

26. $\dfrac{-5 - (-2) + 8 - 4(5)}{6 - 4(-3)}$

$= \dfrac{-5 + 2 + 8 - 20}{6 + 12} = \dfrac{-15}{18} = \mathbf{-\dfrac{5}{6}}$

27. $(-2)[|-3 - 4 - 5| - 2^3 - (-1)]$

$= (-2)[|-12| - 8 + 1] = (-2)[12 - 8 + 1]$

$= -2[5] = \mathbf{-10}$

28. $\dfrac{-3 - (-2) + 9 - (-5)}{7(|-3 + 4|)}$

$= \dfrac{-3 + 2 + 9 + 5}{7(1)} = \mathbf{\dfrac{13}{7}}$

29. $4(-2)[-(7 - 3)(5 - 2)2] = -8[-(4)(3)(2)]$

$= -8[-24] = \mathbf{192}$

30. $4 - (-4) - 5(3 - 1) + 3(4)(-2)^3$

$= 4 + 4 - 5(2) + 3(4)(-8)$

$= 4 + 4 - 10 - 96 = \mathbf{-98}$

Problem Set B

1. $A_{\text{Shaded}} = A_{\text{Square}} - A_{\text{Circle}}$

$= [(8)(8) - \pi(4)^2]\ \text{m}^2$

$= (64 - 16\pi)\ \text{m}^2 \approx \mathbf{13.76\ m^2}$

2. $A_{\text{Shaded}} = A_{\text{Total}} - A_{\text{Not Shaded}}$

$= \left[\frac{1}{2}(12)(10)\right]\text{m}^2$

$- \left[(3)(4) + \frac{1}{2}(3)(6) + \frac{1}{2}(9)(4)\right]\text{m}^2$

$= 60\ \text{m}^2 - 39\ \text{m}^2 = \mathbf{21\ m^2}$

3. $A_{\text{Shaded}} = A_{\text{Circle}} - A_{\text{Triangle}}$

$= \left[\pi(8)^2 - \frac{1}{2}(16)(8)\right]\text{cm}^2$

$= (64\pi - 64)\ \text{cm}^2 \approx \mathbf{136.96\ cm^2}$

4. Perimeter $= \left[\frac{1}{2}(2)(\pi)(2) + 14\right]\text{m}$

$= (2\pi + 14)\ \text{m} \approx \mathbf{20.28\ m}$

5. Area of 40° sector $= \dfrac{40}{360}(A_{\text{Circle}})$

$= \dfrac{40}{360}[\pi(5)^2]\ \text{m}^2$

$= \dfrac{40}{360}(25\pi)\ \text{m}^2 \approx \mathbf{8.72\ m^2}$

6. $V_{\text{Pyramid}} = \frac{1}{3}V_{\text{Prism}}$

$= \frac{1}{3}[A_{\text{Base}} \times \text{height}]$

$= \frac{1}{3}\left[\frac{1}{2}(6)(4)\ \text{cm}^2 \times 10\ \text{cm}\right]$

$= \frac{1}{3}(120)\ \text{cm}^3 = \mathbf{40\ cm^3}$

7. $A_{\text{Base}} = \left[(3)(4) + \frac{1}{2}\pi(2)^2\right]\text{m}^2$

$= (12 + 2\pi)\ \text{m}^2 \approx \mathbf{18.28\ m^2}$

$V_{\text{Cylinder}} = A_{\text{Base}} \times \text{height}$

$= (12 + 2\pi)\ \text{m}^2 \times 8\ \text{m}$

$= (96 + 16\pi)\ \text{m}^3 \approx \mathbf{146.24\ m^3}$

8. $V_{\text{Sphere}} = \frac{2}{3}V_{\text{Cylinder}}$

$= \frac{2}{3}[A_{\text{Base}} \times \text{height}]$

$= \frac{2}{3}[\pi(6)^2\ \text{cm}^2 \times 12\ \text{cm}]$

$= \frac{2}{3}(36\pi)(12)\ \text{cm}^3 \approx \mathbf{904.32\ cm^3}$

$S.A. = 4\pi r^2 = 4\pi(6)^2\ \text{cm}^2 \approx \mathbf{452.16\ cm^2}$

9. Area of 72° sector $= \dfrac{72}{360}(A_{\text{Circle}})$

$= \dfrac{72}{360}[\pi(10)^2]\ \text{cm}^2$

$= \dfrac{72}{360}(100\pi)\ \text{cm}^2 \approx \mathbf{62.8\ cm^2}$

10. Perimeter $= \left[\frac{1}{2}(2)(\pi)(2) + 16 + 4\right]\text{yd}$

$+ \left[\frac{1}{2}(2)(\pi)(2)\right]\text{yd}$

$= (4\pi + 20)\ \text{yd} \approx \mathbf{32.56\ yd}$

11. $z + 70 = 180$

$z = 180 - 70$

$z = \mathbf{110}$

Since vertical angles are equal,

$2x = 70$

$x = \mathbf{35}$

$y = \mathbf{110}$

12. $5A + 40 = 90$
$5A = 90 - 40$
$5A = 50$
$A = \frac{50}{5} = \mathbf{10}$

13. $2B + 140 = 180$
$2B = 180 - 140$
$2B = 40$
$B = \frac{40}{2} = \mathbf{20}$

14. Angle + Complement = 90°
Angle + 10° = 90°
Angle = 90° − 10° = **80°**

15. Angle + Supplement = 180°
Angle + 60° = 180°
Angle = 180° − 60° = **120°**

16. $-2^2 - 2^3 - (-2)^2 - 2$
$= -4 - 8 - 4 - 2 = \mathbf{-18}$

17. $-2^2 - |-4| + |4| = -4 - 4 + 4 = \mathbf{-4}$

18. $-|-3| - 3 - 3^2 = -3 - 3 - 9 = \mathbf{-15}$

19. $-4 - (-3)^3 - 2^2 + |-4|$
$= -4 + 27 - 4 + 4 = \mathbf{23}$

20. $-3^2 - 2(-4 + 6) = -9 - 2(2) = \mathbf{-13}$

21. $-4(-2^2 - 3) - 5 + |-3| = -4(-4 - 3) - 5 + 3$
$= -4(-7) - 5 + 3 = 28 - 5 + 3 = \mathbf{26}$

22. $-2[-1 - (-5)] - [-6(-2) + 3]$
$= -2[-1 + 5] - [12 + 3]$
$= -2[4] - [15] = -8 - 15 = \mathbf{-23}$

23. $-2^2 - 2^3 - 2 - |-2| = -4 - 8 - 2 - 2 = \mathbf{-16}$

24. $-2 - |-3 - 4 + 8| - 2^2 = -2 - |1| - 4$
$= -2 - 1 - 4 = \mathbf{-7}$

25. $-|-2 - 3 - 4| - |-2| = -|-9| - |-2|$
$= -9 - 2 = \mathbf{-11}$

26. $\frac{-5 - (-2) + 8 - 4(5) - 3}{6 - 4(-3)}$
$= \frac{-5 + 2 + 8 - 20 - 3}{6 + 12} = \frac{-18}{18} = \mathbf{-1}$

27. $(-2)[|-3 + 4 - 5| - 2^3 - (-1)]$
$= (-2)[|-4| - 8 + 1] = (-2)[4 - 8 + 1]$
$= (-2)(-3) = \mathbf{6}$

28. $\frac{-|-5| - (-2) + 6 - 4(3 - |6 - 9|)}{5 - |(4)(-3)|}$
$= \frac{-5 + 2 + 6 - 4(3 - 3)}{5 - |-12|}$
$= \frac{-5 + 2 + 6 - 0}{5 - 12} = \frac{3}{-7} = \mathbf{-\frac{3}{7}}$

29. $\frac{-2 - (-3 - 2) - (-2 + 5)}{-4(2^2 - 3)(-2)}$
$= \frac{-2 - (-5) - (3)}{-4(1)(-2)} = \frac{-2 + 5 - 3}{8}$
$= \frac{0}{8} = \mathbf{0}$

30. $-2(-3 + 4 - 6) - 2^2(-2) - 3(-2) - |-5|$
$= -2(-5) - 4(-2) + 6 - 5$
$= 10 + 8 + 6 - 5 = \mathbf{19}$

Practice Set 1

a. $m\angle A = m\angle C$ because they are angles opposite equal sides.
$m\angle C = \mathbf{35°}$
$m\angle B = 180° - m\angle A - m\angle C$
$m\angle B = 180° - 35° - 35°$
$m\angle B = \mathbf{110°}$

b. $x = 180 - 145$
$x = \mathbf{35}$
$y = 180 - x - 40$
$y = 180 - 35 - 40$
$y = \mathbf{105}$

c. $A = 180 - 130$
$A = \mathbf{50}$
$C = A$
$C = \mathbf{50}$
$2B = 180 - C$
$B = \frac{(180 - 50)}{2}$
$B = \mathbf{65}$

d. $\frac{3}{4}\overline{SF} = \frac{6}{5}$
$\overline{SF} = \frac{6}{5} \cdot \frac{4}{3} = \frac{24}{15} = \frac{8}{5}$
$x = \frac{5}{3}\overline{SF} = \frac{5}{3} \cdot \frac{8}{5} = \mathbf{\frac{8}{3}}$

Problem Set 1

1. Since angles opposite equal sides are equal angles, $x = \mathbf{45}$.

$$y + 45 + 45 = 180$$
$$y = 180 - 90 = \mathbf{90}$$

2. Since angles opposite equal sides are equal angles, $x = \mathbf{55}$.

$$y + 55 + 55 = 180$$
$$y = 180 - 110 = \mathbf{70}$$

3. $2C + 70 = 180$

$$2C = 110$$
$$C = \mathbf{55}$$

Since lines are parallel, $B = \mathbf{110}$ and $A = \mathbf{70}$.

4. $2 \times \overrightarrow{SF} = 3$

$$\overrightarrow{SF} = \frac{3}{2}$$
$$3 \times \overrightarrow{SF} = x$$
$$3\left(\frac{3}{2}\right) = x$$
$$x = \mathbf{\frac{9}{2}}$$

5. $A_{\text{Top Shaded}} = \left[\frac{1}{2}\pi(4)^2 - \frac{1}{2}(8)(4)\right] \text{cm}^2$

$$= (8\pi - 16)\text{ cm}^2$$

$$A_{\text{Bottom Shaded}} = \frac{60}{360}[\pi(4)^2]\text{ cm}^2$$
$$= \frac{60}{360}(16\pi)\text{ cm}^2$$

$$A_{\text{Shaded}} = A_{\text{Top Shaded}} + A_{\text{Bottom Shaded}}$$
$$= (8\pi - 16)\text{ cm}^2 + \frac{60}{360}(16\pi)\text{ cm}^2$$
$$= \left(8\pi + \frac{8}{3}\pi - 16\right)\text{ cm}^2 \approx \mathbf{17.49\ cm^2}$$

6. $A_{\text{Total}} = \left[\frac{1}{2}(8)(6) + \frac{1}{2}\pi(5)^2 + \frac{1}{2}\pi(4)^2 + \frac{1}{2}\pi(3)^2\right] \text{cm}^2$

$$= (24 + 25\pi)\text{ cm}^2$$

$$A_{\text{White Triangles}} = \left[\frac{1}{2}(5)(5) + \frac{1}{2}(4)(4) + \frac{1}{2}(3)(3)\right] \text{cm}^2$$
$$= 25\text{ cm}^2$$

$$A_{\text{Shaded}} = A_{\text{Total}} - A_{\text{White Triangles}}$$
$$= (24 + 25\pi)\text{ cm}^2 - 25\text{ cm}^2$$
$$= (25\pi - 1)\text{ cm}^2 \approx \mathbf{77.5\ cm^2}$$

7. $\text{Perimeter} = \left[\frac{1}{2}(2)(\pi)(4) + 48\right] \text{ft}$

$$= (4\pi + 48)\text{ ft} \approx \mathbf{60.56\ ft}$$

8. $V_{\text{Cylinder}} = A_{\text{Base}} \times \text{height}$

$$= [\pi(4)^2\text{ ft}^2 \times 8\text{ ft}]$$
$$= 128\pi\text{ ft}^3 \approx \mathbf{401.92\ ft^3}$$

$$V_{\text{Sphere}} = \frac{2}{3}V_{\text{Cylinder}}$$
$$= \frac{2}{3}(128\pi)\text{ ft}^3 \approx \mathbf{267.95\ ft^3}$$

9. $p + 30 = 180$

$$p = 180 - 30 = \mathbf{150}$$
$$2y + 30 = 90$$
$$2y = 90 - 30$$
$$y = \mathbf{30}$$

Since vertical angles are equal angles, $x = \mathbf{30}$.

10. $p + 60 = 180$

$$p = 180 - 60 = \mathbf{120}$$

Since vertical angles are equal angles,

$$10x = 60$$
$$x = \mathbf{6}$$
$$4y = 120$$
$$y = \mathbf{30}$$

11. $\text{Angle} + \text{Complement} = 90°$

$$\text{Angle} + 17° = 90°$$
$$\text{Angle} = 90° - 17° = \mathbf{73°}$$

12. $V_{\text{Cone}} = \frac{1}{3}(A_{\text{Base}} \times \text{height})$

$$= \frac{1}{3}\left[\frac{1}{2}\pi(3)^2 + (5)(6)\right]\text{m}^2 \times 7\text{ m}$$
$$= \frac{1}{3}\left(\frac{9}{2}\pi + 30\right)(7)\text{ m}^3 \approx \mathbf{102.97\ m^3}$$

13. $r = \frac{1}{4}$ side of square

$A_{\text{Square}} = s^2$

$s = 4r$

$A_{\text{Square}} = (4r)^2 = \mathbf{16r^2}$

14. $-[-2(-3 - 2) - (-2 - 3)] = -[-2(-5) - (-5)]$
$= -[10 + 5] = -[15] = \mathbf{-15}$

15. $-2[-2 - 3(-2 - 2)][-2(-4) - 3]$
$= -2[-2 - 3(-4)][-2(-4) - 3]$
$= -2[-2 + 12][8 - 3] = -2[10][5] = \mathbf{-100}$

16. $-2^2 - 2^3[-2 + 3(-2)] - |-2^3|$
$= -4 - 8[-2 - 6] - |-8| = -4 - 8[-8] - 8$
$= -4 + 64 - 8 = \mathbf{52}$

17. $-3 - 2^3 - 4^2 - |-2 - 3(2)|$
$= -3 - 8 - 16 - |-2 - 6|$
$= -3 - 8 - 16 - |-8|$
$= -3 - 8 - 16 - 8 = \mathbf{-35}$

18. $-\{-2[(-3 + 7) - (-2)][-3(-2 + 1)]\}$
$= -\{-2[4 + 2][-3(-1)]\} = -\{-2[6][3]\}$
$= -\{-36\} = \mathbf{36}$

19. $3^2 - 3^3 + 3^4 - (-3)^3 - 3$
$= 9 - 27 + 81 - (-27) - 3$
$= 9 - 27 + 81 + 27 - 3 = \mathbf{87}$

20. $-(-4)^2 - 4|-2| - 2^3 + |-11 - 4|$
$= -16 - 4(2) - 8 + |-15|$
$= -16 - 8 - 8 + 15 = \mathbf{-17}$

21. $6 - \{[3^2 - 8 + (-2)][-(4 - 6)(-3)^2 + 2]2\}$
$= 6 - \{[9 - 8 - 2][-(-2)(9) + 2]2\}$
$= 6 - \{[9 - 8 - 2][18 + 2]2\}$
$= 6 - \{[-1][20]2\} = 6 - \{-40\}$
$= 6 + 40 = \mathbf{46}$

22. $-[-(-2)] - |-4 - 3|2^2 - 4$
$= -[2] - |-7|4 - 4 = -2 - 7(4) - 4$
$= -2 - 28 - 4 = \mathbf{-34}$

23. $(-|-3|)[(2 - 7)(-3 - 2) + (-2)^2]$
$= -3[-5(-5) + 4] = -3[25 + 4]$
$= -3[29] = \mathbf{-87}$

24. $\dfrac{-|-4| - (-3) + 7 - 6(4 - |7 - 11|)}{7 - |(3)(-2)|}$
$= \dfrac{-4 + 3 + 7 - 6(4 - |-4|)}{7 - |-6|}$
$= \dfrac{-4 + 3 + 7 - 6(4 - 4)}{7 - 6}$
$= \dfrac{-4 + 3 + 7 - 6(0)}{1}$
$= \dfrac{-4 + 3 + 7 - 0}{1} = \dfrac{6}{1} = \mathbf{6}$

25. $-(-3 - 2)(-7 - |-3 - 2|) - (-3)^2$
$= -(-5)(-7 - |-5|) - 9 = 5(-7 - 5) - 9$
$= 5(-12) - 9 = -60 - 9 = \mathbf{-69}$

26. $(-3)[|-2 - 7 - 2| - (-3)^2 - (-2)]$
$= -3[|-11| - 9 + 2] = -3[11 - 9 + 2]$
$= -3[4] = \mathbf{-12}$

27. $\dfrac{-4 - (-3) + 7 - 6(2)}{7 - (3)(-2)}$
$= \dfrac{-4 + 3 + 7 - 12}{7 + 6} = \dfrac{-6}{13} = \mathbf{-\dfrac{6}{13}}$

28. $3 - 5 - 2^2 - 4^2(-1)(-3 - |-2 - 5| - 3)$
$= 3 - 5 - 4 - 16(-1)(-3 - |-7| - 3)$
$= 3 - 5 - 4 - 16(-1)(-3 - 7 - 3)$
$= 3 - 5 - 4 - 16(-1)(-13)$
$= 3 - 5 - 4 - 208 = \mathbf{-214}$

29. $-8 + (-3)(-2)^2 + (-7) - 2(-4 - 2)$
$= -8 + (-3)(4) - 7 - 2(-6)$
$= -8 - 12 - 7 + 12 = \mathbf{-15}$

30. $6(-3)[-(5 - 4)(6 - 2)3] = -18[-1(4)(3)]$
$= -18[-12] = \mathbf{216}$

Practice Set 2

a. $-4^{-2} = \frac{1}{-4^2} = \frac{1}{-16} = \mathbf{-\frac{1}{16}}$

b. $-(-4)^{-2} = \frac{1}{-(-4)^2} = \frac{1}{-(16)} = \mathbf{-\frac{1}{16}}$

c. $\frac{(x^2y^{-2})^0(x^{-3}y)^{-2}}{y^{-8}x^4y^2x^3} = \frac{x^0y^0x^6y^{-2}}{y^{-8}x^4y^2x^3}$

$= \frac{x^6y^{-2}}{x^7y^{-6}} = \mathbf{\frac{y^4}{x}}$

d. $A = \pi r^2 = 49\pi \text{ cm}^2$

$r^2 = 49 \text{ cm}^2$

$r = 7 \text{ cm}$

$C = 2\pi r = 2\pi(7 \text{ cm}) = \mathbf{14\pi \text{ cm}}$

Problem Set 2

1. $4 \times \overrightarrow{SF} = 6$

$\overrightarrow{SF} = \frac{6}{4} = \frac{3}{2}$

$3 \times \overrightarrow{SF} = x$

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

$x = \mathbf{\frac{9}{2}}$

2. Since angles opposite equal sides are equal angles,

$x = \mathbf{38.}$

$y + 38 + 38 = 180$

$y = 180 - 38 - 38 = \mathbf{104}$

3. $V_{\text{Cylinder}} = A_{\text{Base}} \times \text{height}$

$= \left[\frac{60}{360}(\pi(4)^2) + \frac{1}{2}(4)(7)\right]\text{m}^2 \times 8 \text{ m}$

$= \left[\frac{60}{360}(16\pi) + 14\right](8) \text{ m}^3 \approx \mathbf{178.99 \text{ m}^3}$

4. Since vertical angles are equal angles,

$4A = 80$

$A = \mathbf{20}$

$2B + 80 = 180$

$2B = 100$

$B = \mathbf{50}$

Since lines are parallel,

$2C = 4A$

$2C = 80$

$C = \mathbf{40}$

5. $A + 60 = 180$

$A = 180 - 60 = \mathbf{120}$

Since vertical angles are equal angles,

$2B = 60$

$B = \mathbf{30}$

$3C = 120$

$C = \mathbf{40}$

6. $A_{\text{Square}} = s^2 = 16 \text{ cm}^2$

$s = \sqrt{16 \text{ cm}^2} = \mathbf{4 \text{ cm}}$

$r = \frac{1}{4}(s) = \frac{1}{4}(4 \text{ cm}) = \mathbf{1 \text{ cm}}$

$A_{\text{Circle}} = \pi r^2 \approx 3.14(1 \text{ cm})^2 = \mathbf{3.14 \text{ cm}^2}$

7. $V_{\text{Cylinder}} = A_{\text{Base}} \times \text{height}$

$250\pi \text{ cm}^3 = [\pi(5)^2] \text{ cm}^2 \times \text{height}$

$250\pi \text{ cm}^3 = 25\pi \text{ cm}^2 \times \text{height}$

$\text{height} = \frac{250\pi \text{ cm}^3}{25\pi \text{ cm}^2} = \mathbf{10 \text{ cm}}$

8. $V_{\text{Cone}} = \frac{1}{3} \times A_{\text{Base}} \times \text{height}$

$= \frac{1}{3}\left[\frac{1}{2}(1)(2) + (2)(2) + \frac{1}{2}\pi(1)^2\right]\text{m}^2 \times 4\text{m}$

$= \frac{1}{3}\left(5 + \frac{\pi}{2}\right)(4) \text{ m}^3 \approx \mathbf{8.76 \text{ m}^3}$

9. $\frac{xx^2(x^0y^{-1})^2}{x^2x^{-5}(y^2)^5} = \frac{xx^2x^0y^{-2}}{x^2x^{-5}y^{10}} = \frac{x^3y^{-2}}{x^{-3}y^{10}}$

$= \mathbf{x^6y^{-12}}$

10. $\frac{m^2p^0(m^{-2}p)^2}{m^{-2}p^{-1}(m^{-3}p^2)^3} = \frac{m^2p^0m^{-4}p^2}{m^{-2}p^{-1}m^{-9}p^6}$

$= \frac{m^{-2}p^2}{m^{-11}p^5} = \mathbf{m^9p^{-3}}$

11. $\frac{(x^2y)^0xy}{x^2(y^{-2})^3} = \frac{x^0y^0xy}{x^2y^{-6}} = \frac{xy}{x^2y^{-6}} = \mathbf{x^{-1}y^7}$

12. $\dfrac{(a^2b^0)^2\,ab^{-2}}{a^2b^{-2}(ab^{-3})^2} = \dfrac{a^4b^0ab^{0-2}}{a^2b^{-2}a^2b^{-6}} = \dfrac{a^5b^{-2}}{a^4b^{-8}}$
$= \boldsymbol{ab^6}$

13. $\dfrac{(xm^{-1})^{-3}x^2m^2}{(x^0y^2)^{-2}xy} = \dfrac{x^{-3}m^3x^2m^2}{x^0y^{-4}xy} = \dfrac{x^{-1}m^5}{xy^{-3}}$
$= \boldsymbol{\dfrac{m^5y^3}{x^2}}$

14. $\dfrac{(c^2d)^{-3}c^{-5}}{(c^2d^0)^{-2}d^3} = \dfrac{c^{-6}d^{-3}c^{-5}}{c^{-4}d^0d^3} = \dfrac{c^{-11}d^{-3}}{c^{-4}d^3}$
$= \boldsymbol{\dfrac{1}{c^7d^6}}$

15. $\dfrac{(m^2n^{-5})^{-2}m(n^0)^2}{(m^2n^{-2})^{-3}m^2} = \dfrac{m^{-4}n^{10}mn^0}{m^{-6}n^6m^2}$
$= \dfrac{m^{-3}n^{10}}{m^{-4}n^6} = \boldsymbol{mn^4}$

16. $\dfrac{(x^{-2}y^5)^3(x^2)^0y}{xy^{-3}x^{-2}} = \dfrac{x^{-6}y^{15}x^0y}{xy^{-3}x^{-2}} = \dfrac{x^{-6}y^{16}}{x^{-1}y^{-3}}$
$= \boldsymbol{\dfrac{y^{19}}{x^5}}$

17. $\dfrac{(b^2c^{-2})^{-3}c^{-3}}{(b^2c^0b^{-2})^4} = \dfrac{b^{-6}c^6c^{-3}}{b^8c^0b^{-8}} = \dfrac{b^{-6}c^3}{1}$
$= \boldsymbol{\dfrac{c^3}{b^6}}$

18. $\dfrac{(abc)^{-3}c^2b}{a^{-4}bc^2a} = \dfrac{a^{-3}b^{-3}c^{-3}c^2b}{a^{-4}bc^2a} = \dfrac{a^{-3}b^{-2}c^{-1}}{a^{-3}bc^2}$
$= \boldsymbol{b^{-3}c^{-3}}$

19. $\dfrac{kL^2k^{-2}}{(k^0L)^2L^{-3}k} = \dfrac{kL^2k^{-2}}{k^0L^2L^{-3}k} = \dfrac{k^{-1}L^2}{kL^{-1}} = \boldsymbol{\dfrac{k^{-2}}{L^{-3}}}$

20. $\dfrac{s^2ym^{-3}}{(s^0t^2)^{-3}m^{-3}st} = \dfrac{s^2ym^{-3}}{s^0t^{-6}m^{-3}st} = \dfrac{s^2ym^{-3}}{sm^{-3}t^{-5}}$
$= \boldsymbol{\dfrac{1}{s^{-1}t^{-5}y^{-1}}}$

21. $\dfrac{(x^{-3}yz^{-3})^2xy^0}{(xy^0z^{-2})^{-3}xy} = \dfrac{x^{-6}y^2z^{-6}xy^0}{x^{-3}y^0z^6xy} = \dfrac{x^{-5}y^2z^{-6}}{x^{-2}yz^6}$
$= \boldsymbol{\dfrac{x^{-3}z^{-12}}{y^{-1}}}$

22. $\dfrac{x^{-3}y^2xy^4}{(x^{-2}y)^3y^{-3}x} = \dfrac{x^{-3}y^2xy^4}{x^{-6}y^3y^{-3}x} = \dfrac{x^{-2}y^6}{x^{-5}}$
$= \boldsymbol{\dfrac{1}{x^{-3}y^{-6}}}$

23. $-3^{-2} = -\dfrac{1}{3^2} = \boldsymbol{-\dfrac{1}{9}}$

24. $\dfrac{1}{-2^{-3}} = -2^3 = \boldsymbol{-8}$

25. $-3^2 - [-2^0 - (3 - 2) - 2]$
$= -9 - [-1 - 1 - 2]$
$= -9 - [-4] = -9 + 4 = \boldsymbol{-5}$

26. $-2\{[-3 - 2(-2)][-2 - 3(-2)]\}$
$= -2\{[-3 + 4][-2 + 6]\} = -2\{[1][4]\} = \boldsymbol{-8}$

27. $2\{-3^0[(-5 - 2)(-3) - 2]\}$
$= 2\{-1[(-7)(-3) - 2]\} = 2\{-1[21 - 2]\}$
$= 2\{-1[19]\} = 2\{-19\} = \boldsymbol{-38}$

28. $-3[4^0 - 7(2 - 3) - 2^2] = -3[1 - 7(-1) - 4]$
$= -3[1 + 7 - 4] = -3[4] = \boldsymbol{-12}$

29. $-|-2 - 3| - (-5) - 3^3 = -|-5| + 5 - 27$
$= -5 + 5 - 27 = \boldsymbol{-27}$

30. $-|-3^2 - 2| - 2^0 - (-3) = -|-9 - 2| - 1 + 3$
$= -|-11| - 1 + 3 = -11 - 1 + 3 = \boldsymbol{-9}$

Practice Set 3

a. $ab^2 - b = (2)(-3)^2 - (-3) = 2(9) + 3 = \boldsymbol{21}$

b. $xy - (-xy + y) = (2)(-3) - [-(2)(-3) + (-3)]$
$= -6 - [6 - 3] = \boldsymbol{-9}$

c. $\dfrac{2a^{-3}x}{m} - \dfrac{5x}{a^3m} + \dfrac{a^3}{m^{-1}x}$
$= \dfrac{2x}{a^3m} - \dfrac{5x}{a^3m} + \dfrac{a^3m}{x} = \boldsymbol{\dfrac{a^3m}{x} - \dfrac{3x}{a^3m}}$

Problem Set 3

1. $4 \times \overline{SF} = 6$

$$\overline{SF} = \frac{6}{4} = \frac{3}{2}$$

$5 \times \overline{SF} = x$

$$5 \times \frac{3}{2} = x$$

$$x = \mathbf{\frac{15}{2}}$$

Since lines are parallel,

$9z = 81$

$z = \mathbf{9}$

$3y + 9z = 180$

$3y + 81 = 180$

$3y = 99$

$y = \mathbf{33}$

2. $V_{\text{Cone}} = \frac{1}{3}(A_{\text{Base}} \times \text{height})$

$48\pi \text{ m}^3 = \frac{1}{3}[\pi r^2 \times 9 \text{ m}]$

$144\pi \text{ m}^3 = \pi r^2 \times 9 \text{ m}$

$$r = \sqrt{\frac{144\pi \text{ m}^3}{9\pi \text{ m}}} = 4 \text{ m}$$

Circumference $= 2\pi r = 2\pi(4 \text{ m}) \approx \mathbf{25.12 \text{ m}}$

3. Since angles opposite equal sides are equal angles, $A = \mathbf{40}$.

$B + 40 + 40 = 180$

$B = 180 - 40 - 40 = \mathbf{100}$

4. $V_{\text{Cone}} = \frac{1}{3}(A_{\text{Base}} \times \text{height})$

$$= \frac{1}{3}\left[\frac{60}{360}(\pi(5)^2) + \frac{1}{2}(5)(8)\right] \text{cm}^2 \times 10 \text{ cm}$$

$$= \frac{1}{3}\left[\frac{60}{360}(25\pi) + 20\right](10) \text{ cm}^3 \approx \mathbf{110.28 \text{ cm}^3}$$

5. Perimeter $= 2r_8 + 2r_8 + 2r_6 + 2r_5$

$= 2(8\text{cm}) + 2(8\text{cm}) + 2(6\text{cm}) + 2(5 \text{ cm})$

$= 16\text{cm} + 16\text{cm} + 12\text{cm} + 10\text{cm}$

$= \mathbf{54 \text{ cm}}$

6. $x - |x|y^2 - xy = -2 - |-2|(-3)^2 - (-2)(-3)$

$= -2 - 2(9) - 6 = -2 - 18 - 6 = \mathbf{-26}$

7. $(a - b) - a(-b) = (-5 - 3) - (-5)(-3)$

$= -8 - 15 = \mathbf{-23}$

8. $-a(a - ax)(x - a)$

$= -(-2)[-2 - (-2)(4)][4 - (-2)]$

$= 2(-2 + 8)(4 + 2) = 2(6)(6) = \mathbf{72}$

9. $a^2 - y^3(a - y^2)y$

$= (-2)^2 - (-3)^3[-2 - (-3)^2](-3)$

$= 4 + 27(-2 - 9)(-3) = 4 + 27(-11)(-3)$

$= 4 + 891 = \mathbf{895}$

10. $-p^2 - p(a - p^2) = -(-3)^2 - (-3)[4 - (-3)^2]$

$= -9 + 3(4 - 9) = -9 + 3(-5) = -9 - 15$

$= \mathbf{-24}$

11. $a^2 - y^3(a - y^2)y^2 = (-2)^2 - 3^3(-2 - 3^2)3^2$

$= 4 - 27(-2 - 9)9 = 4 - 27(-11)9 = \mathbf{2677}$

12. $a^2 - a(x - ax) = 1^2 - 1[2 - 1(2)]$

$= 1 - 1(2 - 2) = 1 - 1(0) = 1 - 0 = \mathbf{1}$

13. $$\frac{p^2x^4}{m^5} - \frac{2p^4m^5}{x^{-4}} - \frac{3p^2x^2}{x^{-2}m^5} + \frac{7p^2m^{-5}m^{10}x^4}{p^{-2}}$$

$$= \frac{p^2x^4}{m^5} - 2p^4x^4m^5 - \frac{3p^2x^4}{m^5} + 7p^4x^4m^5$$

$$= \mathbf{5p^4x^4m^5 - \frac{2p^2x^4}{m^5}}$$

14. $$-\frac{m^4x^5}{k^5} + \frac{2m^2x^5}{k^5m^{-2}} - \frac{3m^3x^2k}{m^{-4}x^3k^4}$$

$$= -\frac{m^4x^5}{k^5} + \frac{2m^4x^5}{k^5} - \frac{3m^7}{xk^3}$$

$$= \mathbf{\frac{m^4x^5}{k^5} - \frac{3m^7}{xk^3}}$$

15. $$-2x^5y^4 + \frac{3xy^3}{x^{-4}y^{-1}} + \frac{4x^3y^2}{x^2y}$$

$= -2x^5y^4 + 3x^5y^4 + 4xy = \mathbf{x^5y^4 + 4xy}$

16. $$2xy^2m - \frac{3x^2y^2m^4}{m^3x} + \frac{2x^2ym^3}{mx^2}$$

$= 2xy^2m - 3xy^2m + 2ym^2 = \mathbf{2ym^2 - xy^2m}$

17. $$\frac{(x^0y^2)^{-3}y^{-2}p^0}{(x^2)^{-4}(y^2)^0(p^3)^{-2}} = \frac{x^0y^{-6}y^{-2}p^0}{x^{-8}y^0p^{-6}}$$

$$= \frac{x^0y^{-8}p^0}{x^{-8}y^0p^{-6}} = \mathbf{x^8y^{-8}p^6}$$

18. $\dfrac{(mxy^2p)^2\,p^{-2}x^2}{(p^0xmy^3)^{-2}\,xp^{-2}} = \dfrac{m^2x^2y^4p^2p^{-2}x^2}{p^0x^{-2}m^{-2}y^{-6}xp^{-2}}$

$= \dfrac{m^2x^4y^4}{m^{-2}x^{-1}y^{-6}p^{-2}} = \mathbf{m^4x^5y^{10}p^2}$

19. $\dfrac{xx^2(x^{-2})^{-2}(mpx^2)^{-4}}{(x^0)^2(x^2)^0(x^2mp^{-2})^3} = \dfrac{xx^2x^4m^{-4}p^{-4}x^{-8}}{x^0x^0x^6m^3p^{-6}}$

$= \dfrac{x^{-1}m^{-4}p^{-4}}{x^6m^3p^{-6}} = \mathbf{x^{-7}m^{-7}p^2}$

20. $\dfrac{p^2x^{-4}k^5(p^2k)^{-2}}{(p^2x^{-3})^{-2}} = \dfrac{p^2x^{-4}k^5p^{-4}k^{-2}}{p^{-4}x^6}$

$= \dfrac{p^{-2}x^{-4}k^3}{p^{-4}x^6} = \mathbf{p^2x^{-10}k^3}$

21. $\dfrac{x^2xx^0(x^{-2})^2}{xx^3x^{-14}(x^{-2})^{-3}} = \dfrac{x^2xx^0x^{-4}}{xx^3x^{-14}x^6}$

$= \dfrac{x^{-1}}{x^{-4}} = \mathbf{x^3}$

22. $\dfrac{(x^2y^{-2}p^0)^{-3}p^2}{x^2(x^{-4})^0(p^{-2}y^5)^{-2}} = \dfrac{x^{-6}y^6p^0p^2}{x^2x^0p^4y^{-10}}$

$= \dfrac{x^{-6}y^6p^2}{x^2p^4y^{-10}} = \mathbf{x^{-8}y^{16}p^{-2}}$

23. $\dfrac{(x^{-2}y^2)^5(x^0y^{-2})^{-4}}{(x^{-4}yy^2)^2(p^{-4})^0} = \dfrac{x^{-10}y^{10}x^0y^8}{x^{-8}y^2y^4p^0}$

$= \dfrac{x^{-10}y^{18}}{x^{-8}y^6} = \mathbf{x^{-2}y^{12}}$

24. $-3^{-2} + \dfrac{1}{2^{-3}} = -\dfrac{1}{3^2} + 2^3 = -\dfrac{1}{9} + 8 = \mathbf{7\frac{8}{9}}$

25. $-(-2)^3 - \dfrac{1}{(-3)^{-2}} = -(-8) - (-3)^2$

$= 8 - 9 = \mathbf{-1}$

26. $-3[-2 - 2 - (-3)](-2 - 3)$

$= -3[-2 - 2 + 3](-5) = -3[-1](-5) = \mathbf{-15}$

27. $-2(-3 + 7^0) - |(-2 - 3)| = -2(-3 + 1) - |-5|$

$= -2(-2) - 5 = 4 - 5 = \mathbf{-1}$

28. $|-2| - 3^2 - (-3)^3 - 2 = 2 - 9 - (-27) - 2$

$= 2 - 9 + 27 - 2 = \mathbf{18}$

29. $-2\{[(-3 - 2)(-2)](-2 - 3)\}$

$= -2\{[-5(-2)](-5)\} = -2\{[10](-5)\} = \mathbf{100}$

30. $-[(-3)(-2) - (-3)(-2 + 4)] = -[6 + 3(2)]$

$= -[6 + 6] = -[12] = \mathbf{-12}$

Practice Set 4

a. $\dfrac{2a^{-4}b^0}{c}\left(\dfrac{2ab^2c}{x^2} - \dfrac{a^{-2}}{b^{-4}}\right)$

$= \dfrac{4a^{-4}b^0ab^2c}{cx^2} - \dfrac{2a^{-4}b^0a^{-2}}{cb^{-4}}$

$= \mathbf{\dfrac{4b^2}{a^3x^2} - \dfrac{2b^4}{a^6c}}$

b. $2\left(\dfrac{1}{8} - \dfrac{3}{2}x\right) = -\left(-\dfrac{1}{4}x + 2\right)$

$\dfrac{1}{4} - 3x = \dfrac{1}{4}x - 2$

$2 + \dfrac{1}{4} = 3x + \dfrac{1}{4}x$

$\dfrac{9}{4} = \dfrac{13}{4}x$

$\dfrac{9}{4} \cdot \dfrac{4}{13} = x$

$\mathbf{\dfrac{9}{13}} = x$

Problem Set 4

1. $A_{\text{Circle}} = \pi r^2$

Radius $= r$ cm: Area $= \pi(r\text{ cm})^2 = \boldsymbol{\pi r^2}\ \mathbf{cm^2}$

Radius $= 2r$ cm: Area $= \pi(2r\text{ cm})^2 = \mathbf{4}\boldsymbol{\pi r^2}\ \mathbf{cm^2}$

2. Since lines are parallel, $2x = 78$

$x = \mathbf{39}$

$6z + 2x = 180$

$6z + 78 = 180$

$6z = 102$

$z = \mathbf{17}$

$2 \times \overline{SF} = 3$

$\overline{SF} = \dfrac{3}{2}$

$y = \dfrac{7}{2} \times \overline{SF}$

$y = \dfrac{7}{2} \times \dfrac{3}{2} = \mathbf{\dfrac{21}{4}}$

3. $x + y + 100 = 180$

$x + y = 80$

Since angles opposite equal sides are equal angles, $x = y = \mathbf{40.}$

$x + P = 180$

$40 + P = 180$

$P = \mathbf{140}$

$Q + R + P = 180$

$Q + R + 140 = 180$

$Q + R = 40$

Since angles opposite equal sides are equal angles, $Q = R = \mathbf{20.}$

4. $A_{\text{Square}} = s^2 = (6\text{ cm})^2 = \mathbf{36\ cm^2}$

Radius of circle $= \dfrac{s}{6} = \dfrac{6\text{ cm}}{6} = \mathbf{1\ cm}$

$$\begin{aligned} A_{\text{Shaded}} &= A_{\text{Square}} - A_{\text{All circles}} \\ &= 36\text{ cm}^2 - 9\pi(1)^2\text{ cm}^2 \\ &= (36 - 9\pi)\text{ cm}^2 \approx \mathbf{7.74\ cm^2} \end{aligned}$$

5. $A_{\text{Circle}} = A_{\text{Triangle}}$

$\pi r^2 = \dfrac{1}{2}bH$

$\pi(1)^2\text{ cm}^2 = \dfrac{1}{2}(3\text{ cm})(H)$

$H = \dfrac{2\pi}{3}\text{ cm} \approx \mathbf{2.09\ cm}$

6. $15(4 - 5b) = 16(4 - 6b) + 10$

$60 - 75b = 64 - 96b + 10$

$96b - 75b = 64 + 10 - 60$

$21b = 14$

$b = \dfrac{14}{21} = \mathbf{\dfrac{2}{3}}$

7. $3\dfrac{1}{3}x - \dfrac{5}{6} = -\dfrac{2}{3}$

$\dfrac{10}{3}x = -\dfrac{2}{3} + \dfrac{5}{6}$

$\dfrac{10}{3}x = \dfrac{-4}{6} + \dfrac{5}{6}$

$\dfrac{10}{3}x = \dfrac{1}{6}$

$x = \dfrac{1}{6} \cdot \dfrac{3}{10} = \dfrac{3}{60} = \mathbf{\dfrac{1}{20}}$

8. $3(-2x - 3) - 2^2 = -(-3x - 5) - 2$

$-6x - 9 - 4 = 3x + 5 - 2$

$-6x - 13 = 3x + 3$

$-13 - 3 = 3x + 6x$

$-16 = 9x$

$x = \mathbf{-\dfrac{16}{9}}$

9. $-2(2x - 3) - 2^3 - 3 = -x - (-4)$

$-4x + 6 - 8 - 3 = -x + 4$

$-4x - 5 = -x + 4$

$-4 - 5 = -x + 4x$

$-9 = 3x$

$x = \dfrac{-9}{3} = \mathbf{-3}$

10. $4\dfrac{1}{3}x - \dfrac{1}{2} = 3\dfrac{2}{5}$

$\dfrac{13}{3}x = \dfrac{17}{5} + \dfrac{1}{2}$

$\dfrac{13}{3}x = \dfrac{34}{10} + \dfrac{5}{10}$

$\dfrac{13}{3}x = \dfrac{39}{10}$

$x = \dfrac{39}{10} \cdot \dfrac{3}{13} = \dfrac{117}{130} = \mathbf{\dfrac{9}{10}}$

11. $-\dfrac{3}{5}x + \dfrac{2}{7} = 4\dfrac{3}{8}$

$-\dfrac{3}{5}x = \dfrac{35}{8} - \dfrac{2}{7}$

$-\dfrac{3}{5}x = \dfrac{245}{56} - \dfrac{16}{56}$

$-\dfrac{3}{5}x = \dfrac{229}{56}$

$x = \dfrac{229}{56} \cdot -\dfrac{5}{3} = \mathbf{-\dfrac{1145}{168}}$

12. $\dfrac{xy^2}{x^0x^{-3}}\left[\dfrac{xy^{-2}}{x(y^2)^0} - \dfrac{3y^{-2}}{x^4}\right]$

$= \dfrac{xy^2xy^{-2}}{x^0x^{-3}x(y^2)^0} - \dfrac{3xy^2y^{-2}}{x^0x^{-3}x^4}$

$= \dfrac{x^2}{x^{-2}} - \dfrac{3x}{x} = \mathbf{x^4 - 3}$

13. $\dfrac{ay^{-4}}{p}\left(\dfrac{p^{-2}}{ay^2} - \dfrac{3a^{-1}y}{p^{-2}}\right)$

$= \dfrac{ay^{-4}p^{-2}}{pay^2} - \dfrac{3ay^{-4}a^{-1}y}{pp^{-2}} = \mathbf{y^{-6}p^{-3} - 3y^{-3}p}$

14. $\dfrac{(3x^2)^{-2}y^0y^5}{(9y)^{-2}yy^2x^{-3}} = \dfrac{81x^{-4}y^0y^5}{9y^{-2}yy^2x^{-3}} = \dfrac{81x^{-4}y^5}{9yx^{-3}}$

$= \mathbf{9x^{-1}y^4}$

15. $\dfrac{(2yx^{-2})^{-2}yx^2}{(x^2)^0y^{-3}x^2} = \dfrac{y^{-2}x^4yx^2}{4x^0y^{-3}x^2} = \dfrac{y^{-1}x^6}{4y^{-3}x^2}$

$= \mathbf{\dfrac{x^4y^2}{4}}$

16. $\dfrac{2(x^{-2})^{-2}yx^2y^{-3}}{x^0xx^2x^{-5}(x^2)^3} = \dfrac{2x^4yx^2y^{-3}}{x^0xx^2x^{-5}x^6} = \dfrac{2x^6y^{-2}}{x^4}$

$= \mathbf{2x^2y^{-2}}$

17. $\dfrac{(x^2y2x)^{-2}y}{(x^{-4})^0xxy^2} = \dfrac{x^{-4}y^{-2}x^{-2}y}{4x^0xxy^2} = \dfrac{x^{-6}y^{-1}}{4x^2y^2}$

$= \mathbf{\dfrac{x^{-8}y^{-3}}{4}}$

18. $\dfrac{3x^2xy^2x^{-4}}{(x^2y)^{-2}(-2)^{-2}} = \dfrac{12x^2xy^2x^{-4}}{x^{-4}y^{-2}} = \dfrac{12x^{-1}y^2}{x^{-4}y^{-2}}$

$= \mathbf{12x^3y^4}$

19. $\dfrac{2x^2xyx}{x^2y^{-1}} - \dfrac{3x^2y^4}{yy} + \dfrac{7xx^{-3}y^{-2}}{x^{-4}y^{-4}}$

$= 2x^2y^2 - 3x^2y^2 + 7x^2y^2 = \mathbf{6x^2y^2}$

20. $\dfrac{3x}{y} - 7x^2x^{-1}y^{-1} + 2y^2y^{-1}x^{-1}$

$= \dfrac{3x}{y} - \dfrac{7x}{y} + \dfrac{2y}{x} = \mathbf{\dfrac{2y}{x} - \dfrac{4x}{y}}$

21. $\dfrac{2ay^2}{x} + \dfrac{5a^2x^{-1}}{ay^{-2}} + \dfrac{2xy^2}{ay}$

$= \dfrac{2ay^2}{x} + \dfrac{5ay^2}{x} + \dfrac{2xy}{a} = \mathbf{\dfrac{7ay^2}{x} + \dfrac{2xy}{a}}$

22. $a^2(a - ab) = (-2)^2[-2 - (-2)(3)] = 4(-2 + 6)$

$= 4(4) = \mathbf{16}$

23. $x^0yx(xy - x^2) = (-3)^0(-1)(-3)[-3(-1) - (-3)^2]$

$= 3(3 - 9) = 3(-6) = \mathbf{-18}$

24. $a^{-2}b(a - b)(b - a)$

$= (-1)^{-2}(-2)[-1 - (-2)][-2 - (-1)]$

$= -2(-1 + 2)(-2 + 1) = -2(1)(-1) = \mathbf{2}$

25. $ab(a^2 - b)a - b$

$= (-3)(-1)[(-3)^2 - (-1)](-3) - (-1)$

$= 3(9 + 1)(-3) + 1 = 3(10)(-3) + 1 = \mathbf{-89}$

26. $-3^0 - 2^0 - 2^0(-2 - 3^2) - (-2 + 7) - |-2 - 3|$

$= -1 - 1 - 1(-11) - 5 - |-5|$

$= -1 - 1 + 11 - 5 - 5 = \mathbf{-1}$

27. $-2\{2[(-3 - 2^2) - (-3 + 7)] - 2\}$

$= -2\{2[(-7) - 4] - 2\} = -2\{2[-11] - 2\}$

$= -2\{-22 - 2\} = -2\{-24\} = \mathbf{48}$

28. $-3^0 - (-2 - 3 - 2^0)(-3) - (-2 - 4) + (-6)$

$= -1 - (-6)(-3) - (-6) - 6$

$= -1 - 18 + 6 - 6 = \mathbf{-19}$

29. $-2^{-2}(-16) = -\dfrac{1}{2^2}(-16) = -\dfrac{1}{4}(-16) = \dfrac{16}{4} = \mathbf{4}$

30. $-(-2^{-3}) - \dfrac{1}{(-2)^{-2}} = -\left(\dfrac{1}{-2^3}\right) - (-2)^2$

$= -\left(-\dfrac{1}{8}\right) - 4 = \dfrac{1}{8} - 4 = \mathbf{-3\dfrac{7}{8}}$

Practice Set 5

a. $3(-4 + 5N) = 7N - 212$

$-12 + 15N = 7N - 212$

$8N = -200$

$N = \mathbf{-25}$

b. If $\dfrac{3}{8}$ were Victorian, $\dfrac{5}{8}$ were not.

$\dfrac{5}{8} \times 1624 = NV$

$5 \times 203 = NV$

1015 pieces $= NV$

Problem Set 5

1. $(2N - 9)4 = 10N - 8$

$8N - 36 = 10N - 8$

$-36 + 8 = 10N - 8N$

$-28 = 2N$

$N = \mathbf{-14}$

2. $3N_D + 11 = 4N_D - 13$

$11 + 13 = 4N_D - 3N_D$

$\mathbf{24\ ducks} = N_D$

3. $(5N - 8)4 = 6N - 116$

$20N - 32 = 6N - 116$

$20N - 6N = -116 + 32$

$14N = -84$

$N = \mathbf{-6}$

4. $F \times of = is$

$\frac{1}{8} \times C = 12$

$C = 12 \cdot \frac{8}{1} = \mathbf{96\ clowns}$

5. $F \times of = is$

$\frac{2}{7} \times 140{,}000 = N_R$

$\mathbf{40{,}000\ horde\ members} = N_R$

6. $A_{PQR} = \frac{1}{2}bH$

$27\text{ in.}^2 = \frac{1}{2}(6\text{ in.})(H)$

$\mathbf{9\ in.} = H$

$AQ = PQ - PA = 9\text{ in.} - 6\text{ in.} = \mathbf{3\ in.}$

$A_{QAB} = \frac{1}{2}bH = \frac{1}{2}(2)(3)\text{ in.}^2 = \mathbf{3\ in.^2}$

7. Since angles opposite equal sides are equal angles, $y = \mathbf{52}$.

$x + y + 52 = 180$

$x + 52 + 52 = 180$

$x = 180 - 52 - 52 = \mathbf{76}$

8. $K + 110 = 180$

$K = 180 - 110 = \mathbf{70}$

Since lines are parallel, $Q = \mathbf{70}$, $P = \mathbf{110}$, and $D = x = \mathbf{70}$.

Since C is a straight angle, $C = \mathbf{180}$.

9. Circumference $= 2\pi r$

$16\pi\text{ in.} = 2\pi r$

$\mathbf{8\ in.} = r$

$A_{\text{Circle}} = \pi r^2 = \pi(8\text{ in.})^2$

$= 64\pi\text{ in.}^2 \approx \mathbf{200.96\ in.^2}$

$V_{\text{Cylinder}} = A_{\text{Base}} \times \text{height}$

$= (64\pi)\text{ in.}^2 \times 5\text{ in.}$

$= 320\pi\text{ in.}^3 \approx \mathbf{1004.8\ in.^3}$

10. $-3x^0(2x - 3) - (-2^0) - 2 = 5(x - 3^0)2$

$-6x + 9 + 1 - 2 = 10x - 10$

$-6x + 8 = 10x - 10$

$10 + 8 = 10x + 6x$

$18 = 16x$

$x = \frac{18}{16} = \mathbf{\frac{9}{8}}$

11. $-2^2(-2 - x) - x^0(3 - 2) = -2(x + 3)$

$8 + 4x - 3 + 2 = -2x - 6$

$4x + 7 = -2x - 6$

$2x + 4x = -6 - 7$

$6x = -13$

$x = \mathbf{-\frac{13}{6}}$

12. $3\frac{1}{2}x + 2\frac{1}{4} = -\frac{1}{8}$

$\frac{7}{2}x = -\frac{1}{8} - \frac{9}{4}$

$\frac{7}{2}x = -\frac{1}{8} - \frac{18}{8}$

$\frac{7}{2}x = \frac{-19}{8}$

$x = \frac{-19}{8} \cdot \frac{2}{7} = -\frac{38}{56} = \mathbf{-\frac{19}{28}}$

13. $\frac{1}{2}(6 - 8x) + \frac{3}{4}(8x - 12) = 4x + 6$

$$3 - 4x + 6x - 9 = 4x + 6$$
$$2x - 6 = 4x + 6$$
$$-6 - 6 = 4x - 2x$$
$$-12 = 2x$$
$$x = \mathbf{-6}$$

14. $-3 - 3^0 - 3^2(2x - 5) - (-2x - 3)$
$= -x^0(x - 3)$

$$-3 - 1 - 18x + 45 + 2x + 3 = -x + 3$$
$$-16x + 44 = -x + 3$$
$$-16x + x = 3 - 44$$
$$-15x = -41$$
$$x = \mathbf{\frac{41}{15}}$$

15. $-2^3 - \frac{1}{-2^{-2}}(x + 2) - 3x = -2^0(-2x^0 - 4)$

$$-8 + 4x + 8 - 3x = 2 + 4$$
$$x = \mathbf{6}$$

16. $-3[x - 2 - 3(2)] + 2[x - 3(x - 2)]$
$= 7(x - 5)$

$$-3x + 6 + 18 + 2x - 6x + 12 = 7x - 35$$
$$-7x + 36 = 7x - 35$$
$$-7x - 7x = -35 - 36$$
$$-14x = -71$$
$$x = \mathbf{\frac{71}{14}}$$

17. $\frac{2ab}{c^2}\left(\frac{c^2a^{-1}}{b} - \frac{3ac}{b}\right) = \frac{2abc^2a^{-1}}{c^2b} - \frac{6abac}{c^2b}$

$$= \frac{2bc^2}{c^2b} - \frac{6a^2bc}{c^2b} = \mathbf{2 - \frac{6a^2}{c}}$$

18. $-\frac{ax^2}{b}\left(\frac{bax^3}{a^2} - 3ax\right) = -\frac{ax^2bax^3}{ba^2} + \frac{3ax^2ax}{b}$

$$= -\frac{a^2bx^5}{ba^2} + \frac{3a^2x^3}{b} = \mathbf{-x^5 + \frac{3a^2x^3}{b}}$$

19. $\frac{(xm^{-2})^0x^0m^0}{xx^2m^0(2x)^{-2}} = \frac{4x^0m^0x^0m^0}{xx^2m^0x^{-2}} = \mathbf{\frac{4}{x}}$

20. $\frac{4c^2dc^{-3}(2cd^{-2})^{-2}}{c^0c^{-3}(c^{-2}d)^2} = \frac{4c^2dc^{-3}2^{-2}c^{-2}d^4}{c^0c^{-3}c^{-4}d^2}$

$$= \frac{c^{-3}d^5}{c^{-7}d^2} = \mathbf{c^4d^3}$$

21. $\frac{p^2m^5(p^{-3})(2p)^{-3}}{m^6(m^{-2})^2mp^3} = \frac{p^2m^5p^{-3}2^{-3}p^{-3}}{m^6m^{-4}mp^3}$

$$= \frac{m^5p^{-4}}{8m^3p^3} = \mathbf{\frac{m^2}{8p^7}}$$

22. $\frac{x^2xy}{y^{-2}} - \frac{3x^5}{xxy^{-3}} + \frac{7x^7}{y^3x^4}$

$$= x^3y^3 - 3x^3y^3 + 7x^3y^{-3} = \mathbf{-2x^3y^3 + 7x^3y^{-3}}$$

23. $-\frac{3a^2x^4}{x} + \frac{2aax^2}{x} - \frac{5x^3}{a^{-2}}$

$$= -3a^2x^3 + 2a^2x - 5a^2x^3 = \mathbf{2a^2x - 8a^2x^3}$$

24. $mx - m(m - mx^2)$

$$= -2(-1) - (-2)[-2 - (-2)(-1)^2]$$
$$= 2 + 2(-2 + 2) = 2 + 2(0) = 2 + 0 = \mathbf{2}$$

25. $a^2 - b(a - b) = \left(-\frac{1}{2}\right)^2 - \frac{1}{4}\left(-\frac{1}{2} - \frac{1}{4}\right)$

$$= \frac{1}{4} - \frac{1}{4}\left(-\frac{2}{4} - \frac{1}{4}\right) = \frac{1}{4} - \frac{1}{4}\left(-\frac{3}{4}\right)$$
$$= \frac{1}{4} + \frac{3}{16} = \frac{4}{16} + \frac{3}{16} = \mathbf{\frac{7}{16}}$$

26. $a - ba(a^2 - b)$

$$= -\frac{1}{2} - \left(-\frac{1}{4}\right)\left(-\frac{1}{2}\right)\left[\left(-\frac{1}{2}\right)^2 - \left(-\frac{1}{4}\right)\right]$$
$$= -\frac{1}{2} - \frac{1}{8}\left(\frac{1}{4} + \frac{1}{4}\right) = -\frac{1}{2} - \frac{1}{8}\left(\frac{2}{4}\right)$$
$$= -\frac{1}{2} - \frac{2}{32} = -\frac{8}{16} - \frac{1}{16} = \mathbf{-\frac{9}{16}}$$

27. $-2(-2 - 3^2) - 2[-2(-3)] = -2(-2 - 9) - 2[6]$

$$= -2(-11) - 2[6] = 22 - 12 = \mathbf{10}$$

28. $-3^2 - (-3)^3 - \frac{1}{-2^2} = -9 + 27 + \frac{1}{4} = \mathbf{18\frac{1}{4}}$

29. $-3^0[-2^0 - 2^2 - 2^3(-2 - 3)]$

$$= -1[-1 - 4 - 8(-5)] = -1[-1 - 4 + 40]$$
$$= -1[35] = \mathbf{-35}$$

30. $-3[(-2^0 + 5) - (-3 + 7) - |-2|]$

$$= -3[4 - 4 - 2] = -3[-2] = \mathbf{6}$$

Practice Set 6

a. If 0.017 were red dwarfs, then $1 - 0.017 = 0.983$ were not.

$$(0.983)(29{,}000) = NRD$$

$$\textbf{28,507 stars} = NRD$$

b. Consecutive even integers: $N,\ N + 2,\ N + 4$

$$3[N + (N + 4)] = 12(N + 2) - 84$$
$$3[2N + 4] = 12N + 24 - 84$$
$$6N + 12 = 12N - 60$$
$$72 = 6N$$
$$12 = N$$

The desired integers are **12, 14,** and **16.**

Problem Set 6

1. $WD \times of = is$

$$0.016T = 480$$
$$T = \textbf{30,000 teachers}$$

2. If 0.653 were prophetic, then 0.347 were not prophetic.

$$WD \times of = is$$
$$0.347(3000) = NP$$
$$\textbf{1041 statements} = NP$$

3. $-3N - 7 = -2N - 4$

$$\mathbf{-3} = N$$

4. $F \times of = is$

$$2\frac{1}{2} \times BW = 175$$

$$BW = 175 \times \frac{2}{5} = \textbf{70 barge workers}$$

5. Odd integers: $N,\ N + 2,\ N + 4$

$$6(N + N + 4) = 8(N + 2) + 28$$
$$12N + 24 = 8N + 44$$
$$4N = 20$$
$$N = 5$$

The desired integers are **5, 7,** and **9.**

6. Integers: $N,\ N + 1,\ N + 2,\ N + 3$

$$4(N + N + 3) = 6(N + 2) + 24$$
$$8N + 12 = 6N + 36$$
$$2N = 24$$
$$N = 12$$

The desired integers are **12, 13, 14,** and **15.**

7. Surface area $= 4\pi r^2 = 46\pi \text{ cm}^2$

$$r = \sqrt{\frac{46\pi \text{ cm}^2}{4\pi}}$$

$$r = \frac{\sqrt{\mathbf{46}}}{\mathbf{2}} \textbf{ cm}$$

8. Since angles opposite equal sides are equal angles, $A = B = \mathbf{34.}$

$$K + A = 180$$
$$K = 180 - 34 = \mathbf{146}$$

Since angles opposite equal sides are equal angles, $M = \mathbf{17.}$

9. $3 \times \overrightarrow{SF} = \frac{11}{3}$

$$\overrightarrow{SF} = \frac{11}{3} \times \frac{1}{3} = \frac{11}{9}$$

$$\frac{15}{2} \times \overrightarrow{SF} = x$$

$$\frac{15}{2} \times \frac{11}{9} = x$$

$$\frac{\mathbf{55}}{\mathbf{6}} = x$$

Since lines are parallel,

$$3B = 130$$
$$B = \frac{\mathbf{130}}{\mathbf{3}}$$

$$2A + 3B = 180$$
$$2A = 180 - 130$$
$$2A = 50$$
$$A = \mathbf{25}$$

10. $A = 2(180 - A)$

$$A = 360 - 2A$$
$$3A = 360$$
$$A = \mathbf{120^\circ}$$

11. $0.005x + 0.6 = 2.05$

$5x + 600 = 2050$

$5x = 1450$

$x = \mathbf{290}$

12. $3\frac{2}{5}x + 1\frac{1}{4} = 7\frac{1}{3}$

$\frac{17}{5}x = \frac{22}{3} - \frac{5}{4}$

$\frac{17}{5}x = \frac{88}{12} - \frac{15}{12}$

$\frac{17}{5}x = \frac{73}{12}$

$x = \frac{73}{12} \cdot \frac{5}{17} = \mathbf{\frac{365}{204}}$

13. $-3(x - 2 + 1) - (-2)^2 - 3(x - 2)$

$= 5x^0(2 - x) - 2x$

$-3x + 6 - 3 - 4 - 3x + 6 = 10 - 5x - 2x$

$-6x + 5 = 10 - 7x$

$x = \mathbf{5}$

14. $-3 - 2^2 - 2(x - 3) = 2[(x - 5)(2 - 5)]$

$-3 - 4 - 2x + 6 = 2[-3x + 15]$

$-2x - 1 = -6x + 30$

$4x = 31$

$x = \mathbf{\frac{31}{4}}$

15. $4(x + 3) - 2^0(-x - 3) = 2x - 4(x^0 - x) - 3^2$

$4x + 12 + x + 3 = 2x - 4 + 4x - 9$

$5x + 15 = 6x - 13$

$\mathbf{28} = x$

16. $\frac{xy}{p}\left(\frac{-3p^{-1}}{xy} + \frac{2p}{x^{-1}y}\right) = \frac{-3xyp^{-1}}{pxy} + \frac{2xyp}{px^{-1}y}$

$= \mathbf{-3p^{-2} + 2x^2}$

17. $-\frac{x^0k}{p}\left(\frac{k^0p}{x} - 2p\right) = -\frac{x^0kk^0p}{px} + \frac{2px^0k}{p}$

$= -\frac{kp}{px} + \frac{2pk}{p} = \mathbf{-kx^{-1} + 2k}$

18. $\frac{(2x^{-2}y^0)^{-2}yx^{-2}}{xxxy^2(y^{-2})^2} = \frac{x^4y^0yx^{-2}}{4x^3y^2y^{-4}} = \frac{x^2y}{4x^3y^{-2}}$

$= \mathbf{\frac{y^3}{4x}}$

19. $\frac{a^0bc^0(a^{-1}b^{-1})^2}{ab(ab^0)abc} = \frac{ba^{-2}b^{-2}}{abaabc} = \frac{a^{-2}b^{-1}}{a^3b^2c}$

$= \mathbf{a^{-5}b^{-3}c^{-1}}$

20. $\frac{(2x^2)^{-3}(xy^0)^{-2}}{2xx^0x^1xxy^2} = \frac{x^{-6}x^{-2}y^0}{8(2)x^4y^2} = \frac{x^{-8}}{16x^4y^2}$

$= \mathbf{\frac{1}{16x^{12}y^2}}$

21. $-2xy + \frac{5x^0xy^{-1}}{y^{-2}} - \frac{5xx^{-1}x^2}{(x^{-1})^{-1}}$

$= -2xy + 5xy - 5x = \mathbf{3xy - 5x}$

22. $-\frac{3x^2xy^2}{y^4} + \frac{2xxx}{y^{-2}} - \frac{3xy}{x^{-2}y^{-1}}$

$= -3x^3y^{-2} + 2x^3y^2 - 3x^3y^2 = \mathbf{-3x^3y^{-2} - x^3y^2}$

23. $xy - x^2y - y = (-2)(-4) - (-2)^2(-4) - (-4)$

$= 8 + 16 + 4 = \mathbf{28}$

24. $a^{-2}b - a(a - b)$

$= \left(-\frac{1}{2}\right)^{-2}\left(\frac{1}{4}\right) - \left(-\frac{1}{2}\right)\left(-\frac{1}{2} - \frac{1}{4}\right)$

$= 1 + \left(\frac{1}{2}\right)\left(-\frac{3}{4}\right) = 1 - \frac{3}{8} = \mathbf{\frac{5}{8}}$

25. $m^2p(mp - p^2) = \left(-\frac{1}{4}\right)^2\left(\frac{1}{5}\right)\left[-\frac{1}{4}\left(\frac{1}{5}\right) - \left(\frac{1}{5}\right)^2\right]$

$= \frac{1}{80}\left(-\frac{1}{20} - \frac{1}{25}\right) = \frac{1}{80}\left(-\frac{9}{100}\right) = \mathbf{-\frac{9}{8000}}$

26. $-3^0[-3^2 - 2(-2 - 3)][-2^0] = -1[-9 + 10][-1]$

$= -1[1][-1] = \mathbf{1}$

27. $-3 - (-3)^2 + (-3)(-6) = -3 - 9 + 18 = \mathbf{6}$

28. $-3^2 + (-3)^2 - 4^2 - |-2 - 2|$

$= -9 + 9 - 16 - 4 = \mathbf{-20}$

29. $-3^{-2} - \frac{2}{-2^{-3}} - 2^0 = -\frac{1}{9} + 16 - 1$

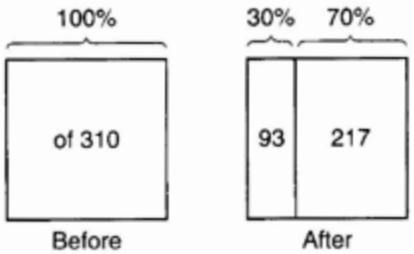
$= -\frac{1}{9} + \frac{135}{9} = \frac{134}{9} = \mathbf{14\frac{8}{9}}$

30. $-(-2)^{-3} - 3^{-2} - 3 = \frac{1}{8} - \frac{1}{9} - 3$

$= \frac{9}{72} - \frac{8}{72} - \frac{216}{72} = -\frac{215}{72} = \mathbf{-2\frac{71}{72}}$

Practice Set 7

a.

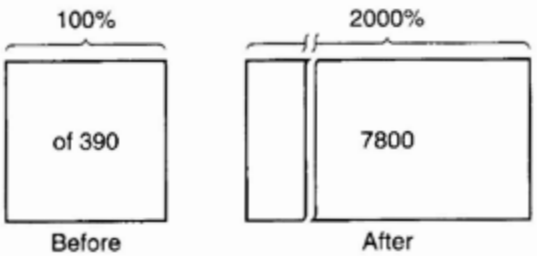


$$\frac{30}{100} \times WN = 93$$

$$\frac{100}{30} \times \frac{30}{100} WN = \frac{100}{30} \times 93$$

$$WN = \mathbf{310}$$

b.



$$\frac{WP}{100} \times 390 = 7800$$

$$\frac{100}{390} \times \frac{WP}{100} \times 390 = 7800 \times \frac{100}{390}$$

$$WP = \mathbf{2000\%}$$

c. $5x - 21 = 2x + 12$

$3x = 33$

$x = \mathbf{11}$

$B = 5x - 21$

$B = 5(11) - 21$

$B = \mathbf{34}$

$A = B$

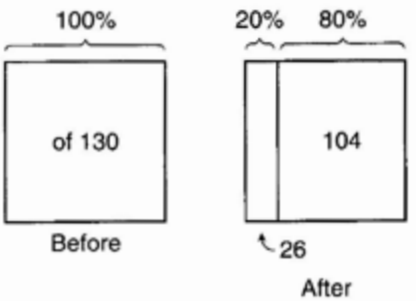
$A = \mathbf{34}$

Problem Set 7

1. $\frac{P}{100} \times of = is \longrightarrow \frac{20}{100} \times WN = 26$

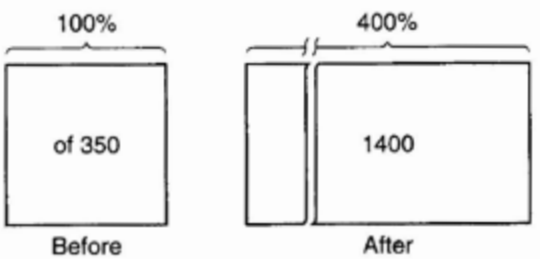
$WN = 26 \cdot \frac{100}{20} = \mathbf{130}$

Since one part of 130 is 26 for 20%, the other part must be 104 for 80%.



2. $\frac{WP}{100} \times of = is \longrightarrow \frac{WP}{100} \times 350 = 1400$

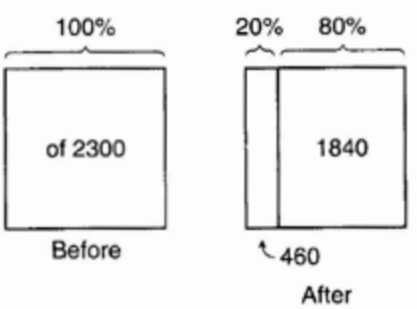
$WP = 1400 \cdot \frac{100}{350} = \mathbf{400\%}$



3. $\frac{P}{100} \times of = is \longrightarrow \frac{20}{100} \times WN = 460$

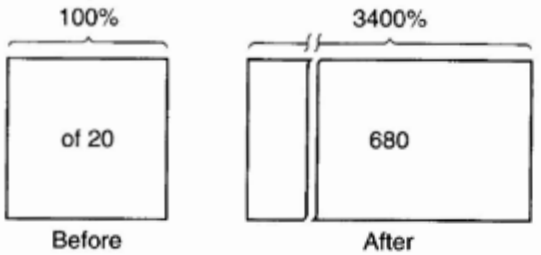
$WN = 460 \cdot \frac{100}{20} = \mathbf{2300}$

Since one part of 2300 is 460 for 20%, the other part must be 1840 for 80%.



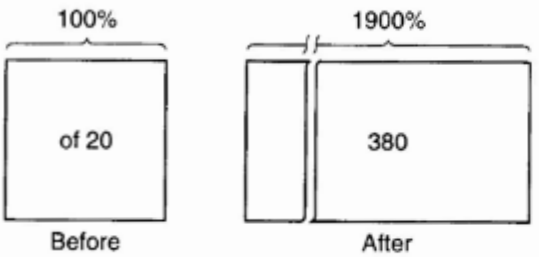
4. $\frac{WP}{100} \times of = is \longrightarrow \frac{WP}{100} \times 20 = 680$

$WP = 680 \cdot \frac{100}{20} = \mathbf{3400\%}$



5. $\frac{P}{100} \times of = is \longrightarrow \frac{1900}{100} \times WN = 380$

$WN = 380 \cdot \frac{100}{1900} = \mathbf{20}$



6. Odd integers: $N,\ N + 2,\ N + 4$

$$\begin{aligned} 7(N + N + 4) &= 10(-N - 2) - 120 \\ 14N + 28 &= -10N - 140 \\ 24N &= -168 \\ N &= -7 \end{aligned}$$

The desired integers are **–7, –5,** and **–3.**

7. Even integers: $N,\ N + 2,\ N + 4$

$$\begin{aligned} 6(N + N + 4) &= 14(N + 2) - 8 \\ 12N + 24 &= 14N + 20 \\ 4 &= 2N \\ 2 &= N \end{aligned}$$

The desired integers are **2, 4,** and **6.**

8. $$\begin{aligned} -2N + 5 &= -N \\ \mathbf{5} &= N \end{aligned}$$

9. $$\begin{aligned} (4x + 15) + (5x + 10) + (x + 5) &= 180 \\ 10x + 30 &= 180 \\ 10x &= 150 \\ x &= \mathbf{15} \end{aligned}$$

10. Since lines are parallel,

$$\begin{aligned} (3x + 20) + (5x) &= 180 \\ 8x + 20 &= 180 \\ 8x &= 160 \\ x &= \mathbf{20} \end{aligned}$$

11. Relabel the angles a, b, c, and d as having measures $x°$, $(3x)°$, $(6x)°$, and $(2x)°$ respectively.

$$\begin{aligned} x + 3x + 6x + 2x &= 180 \\ 12x &= 180 \\ x &= 15 \end{aligned}$$

$m\angle a = \mathbf{15°}$; $m\angle b = \mathbf{45°}$;

$m\angle c = \mathbf{90°}$; $m\angle d = \mathbf{30°}$

12. The sum of $x°$, $y°$, $z°$, and the three 60° angles that touch the vertex must equal 360°, a full circle.

$$\begin{aligned} x + y + z + 60 + 60 + 60 &= 360 \\ x + y + z &= 180 \\ x° + y° + z° &= \mathbf{180°} \end{aligned}$$

13. $$\begin{aligned} -3p(-2 - 3) + p - 2^2 &= -(2p + 4) - p^0 \\ 6p + 9p + p - 4 &= -2p - 4 - 1 \\ 16p - 4 &= -2p - 5 \\ 18p &= -1 \\ p &= -\mathbf{\frac{1}{18}} \end{aligned}$$

14. $$\begin{aligned} 0.005x - 0.07 &= 0.02x + 0.0032 \\ 50x - 700 &= 200x + 32 \\ -732 &= 150x \\ x &= -\frac{732}{150} = -\frac{122}{25} = \mathbf{-4.88} \end{aligned}$$

15. $$\begin{aligned} 2\tfrac{1}{5} + 3\tfrac{1}{8} + 2\tfrac{1}{2}x &= 4\tfrac{3}{20} \\ \frac{5}{2}x &= \frac{166}{40} - \frac{88}{40} - \frac{125}{40} \\ \frac{5}{2}x &= -\frac{47}{40} \\ x &= -\frac{47}{40} \cdot \frac{2}{5} \\ x &= -\frac{94}{200} = -\mathbf{\frac{47}{100}} \end{aligned}$$

16. $3x - 2 - 2^0(x - 3) - 2^0 + 2^2$

$= 5(-x - 2) + 3^0$

$3x - 2 - x + 3 - 1 + 4 = -5x - 10 + 1$

$2x + 4 = -5x - 9$

$7x = -13$

$x = \mathbf{-\frac{13}{7}}$

17. $\frac{2xyp}{y^{-2}}\left(\frac{x^{-1}}{y^3p} - \frac{3x}{yyp^2}\right) = \frac{2xypx^{-1}}{y^{-2}y^3p} - \frac{6xypx}{y^{-2}yyp^2}$

$= \mathbf{2 - 6x^2yp^{-1}}$

18. $\frac{4x^{-2}y}{k}\left(\frac{2kx^2}{y} - \frac{3xy}{k}\right)$

$= \frac{8x^{-2}ykx^2}{ky} - \frac{12x^{-2}yxy}{kk} = \mathbf{8 - 12x^{-1}y^2k^{-2}}$

19. $\frac{(2x^2y^3)^{-3}y}{(4xy)^{-2}(x^{-2}y)^3y} = \frac{16x^{-6}y^{-9}y}{8x^{-2}y^{-2}x^{-6}y^3y}$

$= \frac{2x^{-6}y^{-8}}{x^{-8}y^2} = \mathbf{2x^2y^{-10}}$

20. $\frac{xx^{-2}y(x^{-3})^2xy^0}{(2xy)^{-2}x^2(y^{-3})^2} = \frac{4xx^{-2}yx^{-6}xy^0}{x^{-2}y^{-2}x^2y^{-6}} = \frac{4x^{-6}y}{y^{-8}}$

$= \mathbf{4x^{-6}y^9}$

21. $-\frac{3x^2xy}{p} + \frac{7xyp^{-1}}{x^{-2}} - \frac{2xxxp^{-1}}{y^{-1}}$

$= -\frac{3x^3y}{p} + \frac{7x^3y}{p} - \frac{2x^3y}{p} = \mathbf{\frac{2x^3y}{p}}$

22. $-4xp^2 + \frac{3xxp^4}{p^2x^2} - \frac{2xp}{p^{-1}}$

$= -4xp^2 + 3p^2 - 2xp^2$

$= \mathbf{-6xp^2 + 3p^2}$

23. $-a(a - b) = -\left(-\frac{1}{2}\right)\left(-\frac{1}{2} - \frac{1}{3}\right)$

$= \frac{1}{2}\left(-\frac{3}{6} - \frac{2}{6}\right) = \frac{1}{2}\left(-\frac{5}{6}\right) = \mathbf{-\frac{5}{12}}$

24. $-xy(-x^2 - y) = -\left(-\frac{1}{2}\right)\left(\frac{1}{4}\right)\left[-\left(-\frac{1}{2}\right)^2 - \frac{1}{4}\right]$

$= \frac{1}{8}\left(-\frac{1}{4} - \frac{1}{4}\right) = \frac{1}{8}\left(-\frac{2}{4}\right) = -\frac{2}{32} = \mathbf{-\frac{1}{16}}$

25. $x^3 - x(xy - y)$

$= (-2)^3 - (-2)[(-2)(-4) - (-4)]$

$= -8 + 2(8 + 4) = -8 + 24 = \mathbf{16}$

26. $x - a(a - xa) = 2 - \left(-\frac{1}{2}\right)\left[-\frac{1}{2} - 2\left(-\frac{1}{2}\right)\right]$

$= 2 + \frac{1}{2}\left(-\frac{1}{2} + 1\right) = 2 + \frac{1}{2}\left(\frac{1}{2}\right) = 2 + \frac{1}{4}$

$= \mathbf{2\frac{1}{4}}$

27. $-2\{[-2^0 - 3(-2)] - [-2(-3 - 2)(-2)]\}$

$= -2\{[-1 + 6] - [-2(-5)(-2)]\}$

$= -2\{[5] - [-20]\} = -2\{25\} = \mathbf{-50}$

28. $-2^0 - 2 - 2^2 - (-2)^3 - 2(-2 - 2) - 2$

$= -1 - 2 - 4 + 8 + 4 + 4 - 2 = \mathbf{7}$

29. $3^0(-2 - 3)(-2 + 5)(-2) - (-3 + 7)(-4^0 - 3^0)$

$= (1)(-5)(3)(-2) - 4(-2) = 30 + 8 = \mathbf{38}$

30. $2[(-2^0 - 1)(-2^0 - 15^0) - (-2)^2 - 3^0] - 2$

$= 2[-2(-2) - 4 - 1] - 2 = 2[4 - 4 - 1] - 2$

$= 2[-1] - 2 = -2 - 2 = \mathbf{-4}$

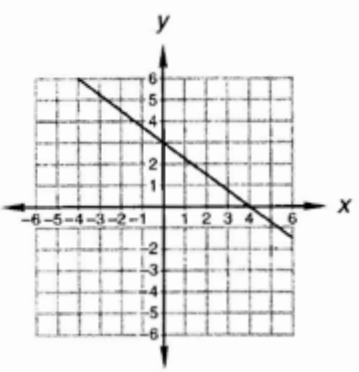
Practice Set 8

$3x + 4y = 12$

$4y = -3x + 12$

$y = -\frac{3}{4}x + 3$

The y-intercept is at (0, 3); the slope is $-\frac{3}{4}$.



Problem Set 8

1. $WD \times of = is$

$0.36 \times K = 828$

$K = \dfrac{828}{0.36} = \mathbf{2300\ knights}$

2. Even integers: $N,\ N + 2,\ N + 4,\ N + 6$

$10(N + N + 6) = 9(N + 2 + N + 6) + 24$

$20N + 60 = 18N + 96$

$2N = 36$

$N = 18$

The desired integers are **18, 20, 22,** and **24.**

3. $3N - 7 = -2N - 72$

$5N = -65$

$N = \mathbf{-13}$

4. $F \times of = is$

$\dfrac{7}{16} \times WN = 420$

$WN = 420 \times \dfrac{16}{7} = \mathbf{960\ warriors}$

5. Odd integers: $N,\ N + 2,\ N + 4$

$5(N + N + 4) = 2(-N - 2) + 108$

$10N + 20 = -2N + 104$

$12N = 84$

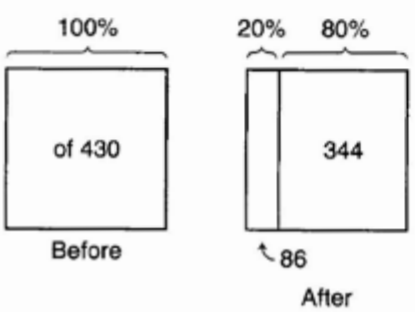
$N = 7$

The desired integers are **7, 9,** and **11.**

6. $\dfrac{P}{100} \times of = is \longrightarrow \dfrac{20}{100} \times WN = 86$

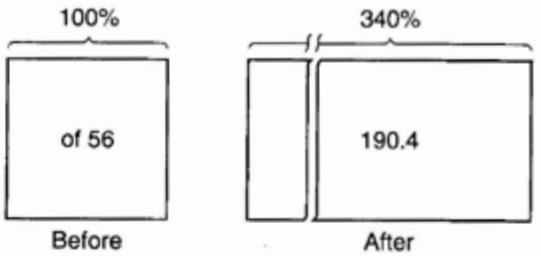
$WN = 86 \cdot \dfrac{100}{20} = \mathbf{430}$

Since one part of 430 is 86 for 20%, the other part must be 344 for 80%.



7. $\dfrac{P}{100} \times of = is \longrightarrow \dfrac{340}{100} \times 56 = WN$

$WN = \dfrac{340}{100} \cdot 56 = \mathbf{190.4}$



8. $A = 2(90 - A) + 3$

$A = 180 - 2A + 3$

$3A = 183$

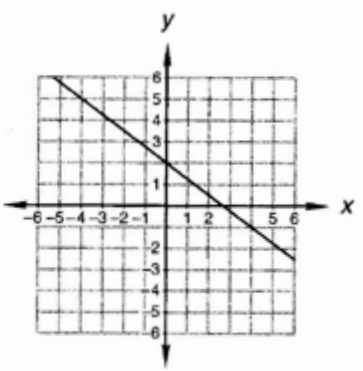
$A = \mathbf{61°}$

9. $3x + 4y = 8$

$4y = -3x + 8$

$y = -\dfrac{3}{4}x + 2$

The y-intercept is 2; the slope is $-\dfrac{3}{4}$.



10. $(2x + 2) + (4x + 4) + (3x + 3) = 180$

$9x + 9 = 180$

$9x = 171$

$x = \mathbf{19}$

11. $A_{\text{Circle}} = \pi r^2 = 25\pi\ \text{m}^2$

$r = \sqrt{\dfrac{25\pi\ \text{m}^2}{\pi}} = 5\ \text{m}$

$r = BD = AC = \mathbf{5\ m}$

12. Since lines are parallel,

$(5x - 19) + (3x - 1) = 180$

$8x - 20 = 180$

$8x = 200$

$x = \mathbf{25}$

8. $y + 140 = 180 \longrightarrow y = \mathbf{40}$

$$(7x + 6) + (6x + 4) + y = 180$$
$$13x + 10 + 40 = 180$$
$$13x = 130$$
$$x = \mathbf{10}$$

9. $(5x + 10) + (7x + 50) = 180$

$$12x + 60 = 180$$
$$12x = 120$$
$$x = \mathbf{10}$$

$5x + 10 = 5(10) + 10 = 50 + 10 = \mathbf{60}$

Since vertical angles are equal angles,

$y + 1 = 60$

$y = \mathbf{59}$

$z + 60 = 180$

$z = \mathbf{120}$

10. $A_{\text{Circle}} = \pi r^2 = 9\pi \text{ m}^2$

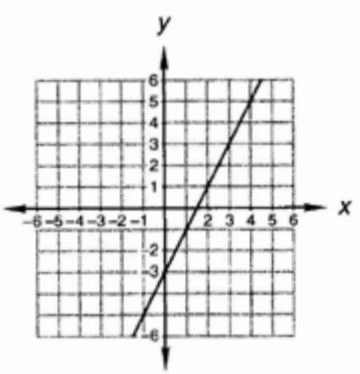
$$r = \sqrt{\frac{9\pi \text{ m}^2}{\pi}} = \mathbf{3 \text{ m}}$$

Circumference $= 2\pi r = 2\pi(3 \text{ m}) = \mathbf{6\pi \text{ m}}$

11. $y - 2x + 3 = 0$

$$y = 2x - 3$$

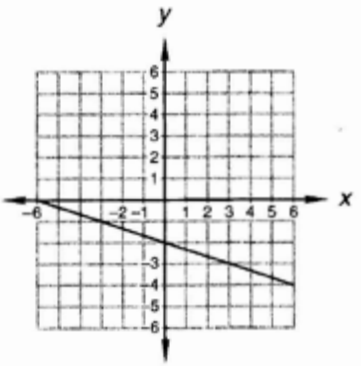
The y-intercept is -3; the slope is $\frac{2}{1}$.



12. $3y + 6 = -x$

$$y = -\frac{1}{3}x - 2$$

The y-intercept is -2; the slope is $-\frac{1}{3}$.



13. $0.02 - 0.003x + x = 5.005$

$$20 - 3x + 1000x = 5005$$
$$997x = 4985$$
$$x = \mathbf{5}$$

14. $-3\frac{1}{5}x + 7\frac{1}{10} = 4\frac{2}{9}$

$$-\frac{16}{5}x = \frac{38}{9} - \frac{71}{10}$$
$$-\frac{16}{5}x = \frac{380}{90} - \frac{639}{90}$$
$$-\frac{16}{5}x = -\frac{259}{90}$$
$$x = -\frac{259}{90}\left(-\frac{5}{16}\right) = \frac{1295}{1440} = \mathbf{\frac{259}{288}}$$

15. $-2[(2 - 3)x + 7(2^0 - 1)] = -3(x - 2)$

$$-2[-x + 7(0)] = -3x + 6$$
$$2x = -3x + 6$$
$$5x = 6$$
$$x = \mathbf{\frac{6}{5}}$$

16. $-2^0(2x - 3) - 4 = 2x - 3^0$

$$-2x + 3 - 4 = 2x - 1$$
$$-2x - 1 = 2x - 1$$
$$0 = 4x$$
$$\mathbf{0} = x$$

17. $\frac{x^0y^2}{p^{-2}}\left(\frac{p^2}{y^2} - \frac{y^{-2}}{p^{-2}}\right) = \frac{x^0y^2p^2}{p^{-2}y^2} - \frac{x^0y^2y^{-2}}{p^{-2}p^{-2}}$

$= p^4 - p^4 = \mathbf{0}$

18. $\dfrac{ak^{-2}}{a^{-3}}\left(\dfrac{2k^4}{a^4} - 3k\right) = \dfrac{2ak^{-2}k^4}{a^{-3}a^4} - \dfrac{3ak^{-2}k}{a^{-3}}$
$= \mathbf{2k^2 - 3a^4k^{-1}}$

19. $\dfrac{(2x^2ya)^{-3}\,ya^3}{x^2y(ay)^{-2}\,y} = \dfrac{x^{-6}y^{-3}a^{-3}ya^3}{8x^2ya^{-2}y^{-2}y} = \dfrac{x^{-6}y^{-2}}{8x^2a^{-2}}$
$= \mathbf{\dfrac{a^2}{8x^8y^2}}$

20. $\dfrac{(-2xyz)^{-3}}{(x^2z^{-3})^{-3}} = -\dfrac{x^{-3}y^{-3}z^{-3}}{8x^{-6}z^9} = \mathbf{-\dfrac{x^3}{8y^3z^{12}}}$

21. $3x - \dfrac{2xy^2}{y} + \dfrac{4xx^{-2}}{(x^2)^{-1}} = 3x - 2xy + 4x$
$= \mathbf{7x - 2xy}$

22. $\dfrac{2xy}{p} - \dfrac{5xxx}{(x^{-2})^{-1}y^{-1}} + \dfrac{3xp^{-1}}{y^{-1}}$
$= \dfrac{2xy}{p} - 5xy + \dfrac{3xy}{p} = \mathbf{\dfrac{5xy}{p} - 5xy}$

23. $-a^2b - a = -\left(-\dfrac{1}{2}\right)^2\left(\dfrac{1}{4}\right) - \left(-\dfrac{1}{2}\right)$
$= -\dfrac{1}{16} + \dfrac{1}{2} = -\dfrac{1}{16} + \dfrac{8}{16} = \mathbf{\dfrac{7}{16}}$

24. $a(a - ab) = -\dfrac{1}{2}\left[-\dfrac{1}{2} - \left(-\dfrac{1}{2}\right)\left(-\dfrac{1}{8}\right)\right]$
$= -\dfrac{1}{2}\left(-\dfrac{1}{2} - \dfrac{1}{16}\right) = -\dfrac{1}{2}\left(-\dfrac{8}{16} - \dfrac{1}{16}\right)$
$= -\dfrac{1}{2}\left(-\dfrac{9}{16}\right) = \mathbf{\dfrac{9}{32}}$

25. $a(a - b)(ab - b) = -2(-2 - 3)[-2(3) - 3]$
$= -2(-5)(-6 - 3) = -2(-5)(-9) = \mathbf{-90}$

26. $a^2(x - ax^2) = (-2)^2[-4 - (-2)(-4)^2]$
$= 4(-4 + 32) = 4(28) = \mathbf{112}$

27. $-2(-3 - 2^0) - 2^0(-2^2 - 2) = -2(-4) - 1(-6)$
$= 8 + 6 = \mathbf{14}$

28. $-3[(-5 + 2)(-2) - (3^0 - 2) - 2]$
$= -3[(-3)(-2) - (-1) - 2] = -3[6 + 1 - 2]$
$= -3[5] = \mathbf{-15}$

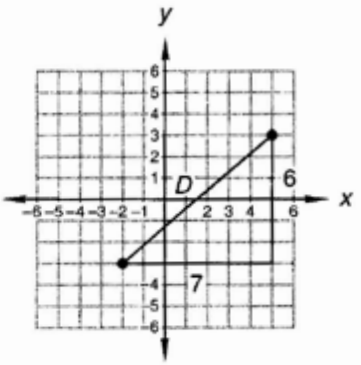
29. $-2^0(-2 - 3^0) - (-2)^3 - |-3|$
$= -1(-3) + 8 - 3$
$= 3 + 8 - 3 = \mathbf{8}$

30. $-\dfrac{1}{-2^{-3}} + \dfrac{1}{-(-2)^{-3}} - 3^2 = 8 + 8 - 9 = \mathbf{7}$

Practice Set 10

a. $a^2 + 5^2 = 9^2$
$a^2 + 25 = 81$
$a^2 = 56$
$a = \sqrt{\mathbf{56}}$

b.



$D^2 = 6^2 + 7^2$
$D^2 = 36 + 49$
$D = \sqrt{\mathbf{85}}$

Problem Set 10

1. If 20% were in a festive mood, then 80% were not in a festive mood.

$\dfrac{P}{100} \times of = is$

$\dfrac{80}{100} \times P = 1400$

$P = 1400 \times \dfrac{100}{80} = \mathbf{1750\ people}$

2. $F \times of = is$

$3\dfrac{1}{4} \times S = 26{,}000$

$S = 26{,}000 \times \dfrac{4}{13} = \mathbf{8000\ soldiers}$

3. $F \times of = is$

$\dfrac{1}{10} \times M = 590$

$M = 590 \times \dfrac{10}{1} = 5900$

$\text{Men}_{\text{After}} = \text{Men}_{\text{Total}} - \text{Men}_{\text{Killed}}$
$\text{Men}_{\text{After}} = 5900 - 590 = \mathbf{5310\ men}$

4. Odd integers: N, $N + 2$, $N + 4$

$$4N = 3(N + 2 + N + 4) - 8$$
$$4N = 6N + 10$$
$$-2N = 10$$
$$N = -5$$

The desired integers are **–5, –3,** and **–1.**

5. $\frac{P}{100} \times of = is$

$$\frac{260}{100} \times OA = 10{,}400$$
$$OA = 10{,}400 \cdot \frac{100}{260} = \mathbf{4000\ minas}$$

6. $\frac{P}{100} \times of = is$

$$\frac{14}{100} \times A_{\text{Total}} = 4200$$
$$A_{\text{Total}} = 4200 \cdot \frac{100}{14} = 30{,}000$$

$$A_{\text{Hidden}} = A_{\text{Total}} - A_{\text{Seen}}$$
$$A_{\text{Hidden}} = 30{,}000 - 4200 = \mathbf{25{,}800\ Argives}$$

7. Circumference $= 2\pi r = 6\pi$ cm

$$r = \frac{6\pi}{2\pi}\text{ cm} = 3\text{ cm}$$

Area $= \pi r^2 = \pi(3\text{ cm})^2 = \mathbf{9\pi\ cm^2}$

8. Since angles opposite equal sides are equal angles, $x = \mathbf{60.}$

$$x + y + 60 = 180$$
$$y = 180 - 60 - 60 = \mathbf{60}$$
$$y + \angle BDC = 180$$
$$\angle BDC = 180 - 60 = 120$$
$$z + 20 + 120 = 180$$
$$z = 180 - 20 - 120 = \mathbf{40}$$

9. $(17x + 20) + (20x - 25) = 180$

$$37x - 5 = 180$$
$$37x = 185$$
$$x = \mathbf{5}$$

Since vertical angles are equal angles,

$$P = 17x + 20$$
$$P = 17(5) + 20 = 105$$

Since lines are parallel,

$Q = P = \mathbf{105.}$

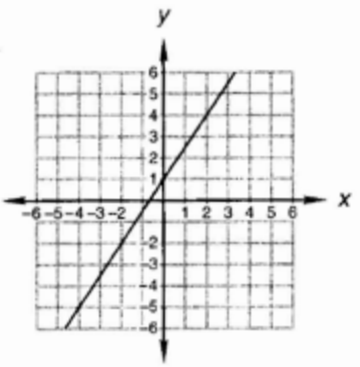
10. $A_{\text{Square}} = 4 \times A_{\text{Shaded}}$

$$= 4 \times 9\text{ m}^2 = \mathbf{36\ m^2}$$
$$A_{\text{Square}} = s^2 = 36\text{ m}^2$$
$$s = \sqrt{36\text{ m}^2} = \mathbf{6\ m}$$

11. $2y = 3x + 2$

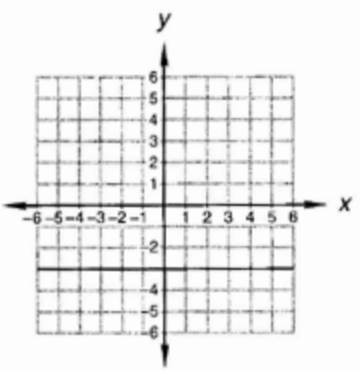
$$y = \frac{3}{2}x + 1$$

The y-intercept is 1; the slope is $\frac{3}{2}$.



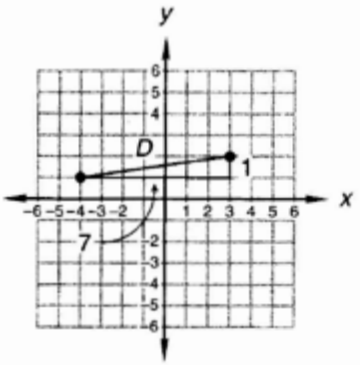
12. $y = -3$

The y-intercept is –3; the slope is 0.



13.
$$c^2 = a^2 + b^2$$
$$7^2 = p^2 + 4^2$$
$$49 = p^2 + 16$$
$$33 = p^2$$
$$\sqrt{\mathbf{33}} = p$$

14.



$D^2 = 1^2 + 7^2$
$D^2 = 1 + 49$
$D^2 = 50$
$D = \sqrt{50}$
$D = \mathbf{5\sqrt{2}}$

15. $\frac{3}{4}x - \frac{1}{5}x = 2\frac{3}{4}$
$\frac{15}{20}x - \frac{4}{20}x = \frac{11}{4}$
$\frac{11}{20}x = \frac{11}{4}$
$x = \frac{11}{4} \cdot \frac{20}{11} = \mathbf{5}$

16. $-5.2 + 3y = 0.2(y + 2)$
$-52 + 30y = 2y + 4$
$28y = 56$
$y = \mathbf{2}$

17. $4x(2 - 3^0) + (-2)(x - 5) = -(3x + 2)$
$8x - 4x - 2x + 10 = -3x - 2$
$2x + 10 = -3x - 2$
$5x = -12$
$x = \mathbf{-\frac{12}{5}}$

18. $\frac{4xy}{m^{-2}}\left(\frac{3y^{-1}}{m^2x} - \frac{2x}{ym}\right) = \frac{12xyy^{-1}}{m^{-2}m^2x} - \frac{8xyx}{m^{-2}ym}$
$= \mathbf{12 - 8x^2m}$

19. $\frac{2x^0y}{p}\left(\frac{2p}{y} - \frac{3xy}{p}\right) = \frac{4x^0yp}{py} - \frac{6x^0yxy}{pp}$
$= \mathbf{4 - 6xy^2p^{-2}}$

20. $\frac{(3x^{-2})^{-2}xy}{3^{-3}x^{-2}(yx^0)^{-3}} = \frac{27x^4xy}{9x^{-2}y^{-3}x^0} = \frac{3x^5y}{x^{-2}y^{-3}}$
$= \mathbf{3x^7y^4}$

21. $\frac{(x^2p^2)^{-3}x^0p^2}{x^{-2}px^0(xp)^{-3}} = \frac{x^{-6}p^{-6}x^0p^2}{x^{-2}px^0x^{-3}p^{-3}} = \frac{x^{-6}p^{-4}}{x^{-5}p^{-2}}$
$= \mathbf{x^{-1}p^{-2}}$

22. $3x + \frac{2x^2x^{-3}}{x^{-2}y^0} - x^0 = 3x + 2x - 1 = \mathbf{5x - 1}$

23. $\frac{5x^2y}{z} - \frac{3z^{-1}y}{x^{-2}} + \frac{7xxy^2z}{yz^2}$
$= \frac{5x^2y}{z} - \frac{3x^2y}{z} + \frac{7x^2y}{z} = \mathbf{\frac{9x^2y}{z}}$

24. $(A + x + 3) + (B + x + 2) + (C + x + 1)$
$= 30$ cm

Since $A = x + 3$; $B = x + 2$; and $C = x + 1$:
$2(x + 3) + 2(x + 2) + 2(x + 1) = 30$ cm
$2x + 6 + 2x + 4 + 2x + 2 = 30$ cm
$6x = 18$ cm
$x = \mathbf{3\ cm}$

25. $b(ab - b) = -\frac{1}{2}\left[\left(-\frac{1}{3}\right)\left(-\frac{1}{2}\right) - \left(-\frac{1}{2}\right)\right]$
$= -\frac{1}{2}\left(\frac{1}{6} + \frac{1}{2}\right) = -\frac{1}{2}\left(\frac{1}{6} + \frac{3}{6}\right) = -\frac{1}{2}\left(\frac{2}{3}\right)$
$= -\frac{2}{6} = \mathbf{-\frac{1}{3}}$

26. $ab - a^2b^2 - b$
$= -\frac{1}{2}\left(-\frac{1}{2}\right) - \left(-\frac{1}{2}\right)^2\left(-\frac{1}{2}\right)^2 - \left(-\frac{1}{2}\right)$
$= \frac{1}{4} - \frac{1}{16} + \frac{1}{2} = \frac{4}{16} - \frac{1}{16} + \frac{8}{16} = \mathbf{\frac{11}{16}}$

27. $a^2(b - ab)b$
$= \left(-\frac{1}{2}\right)^2\left[-\frac{1}{2} - \left(-\frac{1}{2}\right)\left(-\frac{1}{2}\right)\right]\left(-\frac{1}{2}\right)$
$= \frac{1}{4}\left(-\frac{1}{2} - \frac{1}{4}\right)\left(-\frac{1}{2}\right) = \frac{1}{4}\left(-\frac{2}{4} - \frac{1}{4}\right)\left(-\frac{1}{2}\right)$
$= \frac{1}{4}\left(-\frac{3}{4}\right)\left(-\frac{1}{2}\right) = \mathbf{\frac{3}{32}}$

28. $-\frac{1}{2^{-3}} - \frac{1}{-2^{-3}} - (-3 - 2^0) - 2$
$= -8 + 8 + 4 - 2 = \mathbf{2}$

29. $-|-2| - |-2^0| - 3^2 - (-3)^3$
$= -2 - 1 - 9 + 27 = \mathbf{15}$

30. $-\frac{1}{2} - \left(\frac{1}{2}\right)^2 - \left(-\frac{1}{2}\right)^3 - \frac{1}{2}$
$= -\frac{1}{2} - \frac{1}{4} + \frac{1}{8} - \frac{1}{2} = -\frac{4}{8} - \frac{2}{8} + \frac{1}{8} - \frac{4}{8}$
$= \mathbf{-\frac{9}{8}}$

Practice Set 11

a. $\frac{m}{3b} + \frac{ak}{bz^3} - \frac{y}{bz^4} = \frac{mz^4}{3bz^4} + \frac{3akz}{3bz^4} - \frac{3y}{3bz^4}$

$= \mathbf{\frac{mz^4 + 3akz - 3y}{3bz^4}}$

b. $\frac{z}{b} - k + \frac{2mn}{ab^3} = \frac{ab^2z}{ab^3} - \frac{ab^3k}{ab^3} + \frac{2mn}{ab^3}$

$= \mathbf{\frac{ab^2z - ab^3k + 2mn}{ab^3}}$

c. $y = 2(40)$

$y = \mathbf{80}$

$(4x + 20) + (5x + 80) = 360 - 80$

$9x + 100 = 280$

$9x = 180$

$x = \mathbf{20}$

Problem Set 11

1. If 13% believed, 87% did not believe.

$\frac{P}{100} \times of = is$

$\frac{87}{100} \times L_{\text{Total}} = 5220$

$L_{\text{Total}} = 5220 \times \frac{100}{87} = 6000$

$L_{\text{Believed}} = L_{\text{Total}} - L_{\text{Not believed}}$

$L_{\text{Believed}} = 6000 - 5220 = \mathbf{780\ people}$

2. Even integers: N, $N + 2$, $N + 4$, $N + 6$

$-2(N + N + 6) = -N - 4 - 20$

$-4N - 12 = -N - 24$

$-3N = -12$

$N = 4$

The desired integers are **4, 6, 8,** and **10.**

3. $\frac{P}{100} \times of = is$

$\frac{220}{100} \times OP = \$5599$

$OP = \$5599 \times \frac{100}{220} = \$2545$

Increase $= \$5599 - \$2545 = \mathbf{\$3054}$

4. If 30% sat around, 70% worked.

$\frac{P}{100} \times of = is$

$\frac{70}{100} \times P = 1400$

$P = 1400 \times \frac{100}{70} = 2000$

$P_{\text{Sat}} = 2000 - 1400 = \mathbf{600\ people}$

5. $\frac{P}{100} \times of = is$

$\frac{340}{100} \times RP = 6800$

$RP = 6800 \times \frac{100}{340} = 2000$

Total $= 6800 + 2000 = \mathbf{8800\ plums}$

6. Odd integers: N, $N + 2$, $N + 4$, $N + 6$

$-4(N + N + 6) = 10(-N - 4) + 10$

$-8N - 24 = -10N - 30$

$2N = -6$

$N = -3$

The desired integers are **–3, –1, 1,** and **3.**

7. Since angles opposite equal sides are equal angles, $z = \mathbf{32.}$

$y + z + 32 = 180$

$y = 180 - 32 - 32 = \mathbf{116}$

$x + y = 180$

$x + 116 = 180$

$x = \mathbf{64}$

Since the measure of an arc of a circle equals the measure of the central angle, $p = \mathbf{64.}$

8. $A_{\text{Shaded}} = A_{\text{Square}} - A_{3\text{ Triangles}}$

$= (4)(4) - \frac{1}{2}(2)(1) - \frac{1}{2}(2)(3) - \frac{1}{2}(4)(1)$

$= 16 - 1 - 3 - 2$

$= \mathbf{10\ units^2}$

9. $A_{\text{Circle}} = A_{\text{Triangle}}$

$\pi r^2 = \frac{1}{2}bH$

$\pi(\pi\text{ cm})^2 = \frac{1}{2}(\pi\text{ cm})(\text{H})$

$H = \frac{2\pi^3\text{ cm}^2}{\pi\text{ cm}} = \mathbf{2\pi^2\ cm}$

10. $2(3x + 2) + 2(4x - 2) + 2(3x - 2) = 36\text{ m}$

$$6x + 4 + 8x - 4 + 6x - 4 = 36\text{ m}$$
$$20x - 4 = 36\text{ m}$$
$$20x = 40\text{ m}$$
$$x = 2\text{ m}$$

$3x + 2 = 3(2\text{ m}) + 2 = \mathbf{8\text{ m}}$

11. $\dfrac{k}{ax} + \dfrac{bc}{x^2} - \dfrac{m}{ax^3} = \dfrac{kx^2}{ax^3} + \dfrac{abcx}{ax^3} - \dfrac{m}{ax^3}$

$= \boldsymbol{\dfrac{kx^2 + abcx - m}{ax^3}}$

12. $\dfrac{p}{ak} - c + \dfrac{3a}{4k} = \dfrac{4p}{4ak} - \dfrac{4ack}{4ak} + \dfrac{3a^2}{4ak}$

$= \boldsymbol{\dfrac{4p - 4ack + 3a^2}{4ak}}$

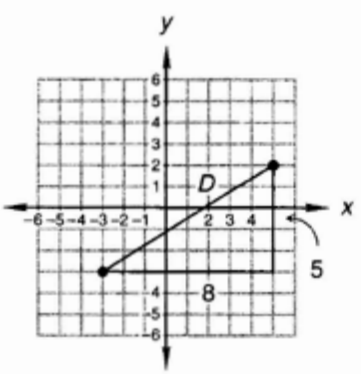
13. $\dfrac{m^2}{p} - \dfrac{3p}{cx} - \dfrac{5}{4c^2x}$

$= \dfrac{4c^2m^2x}{4c^2px} - \dfrac{12cp^2}{4c^2px} - \dfrac{5p}{4c^2px}$

$= \boldsymbol{\dfrac{4c^2m^2x - 12cp^2 - 5p}{4c^2px}}$

14.
$$c^2 = a^2 + b^2$$
$$11^2 = 4^2 + x^2$$
$$121 = 16 + x^2$$
$$105 = x^2$$
$$\sqrt{\mathbf{105}} = x$$

15.

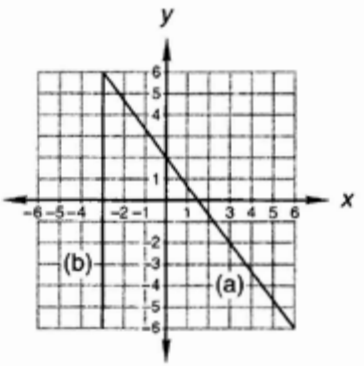


$$D^2 = 5^2 + 8^2$$
$$D^2 = 25 + 64$$
$$D^2 = 89$$
$$D = \sqrt{\mathbf{89}}$$

16. (a) $4x + 3y - 6 = 0$

$$3y = -4x + 6$$
$$y = -\frac{4}{3}x + 2$$

(b) $x = -3$



17. $3\frac{1}{2} - 2\frac{1}{3}x = 3\frac{1}{4}$

$$-\frac{7}{3}x = \frac{13}{4} - \frac{14}{4}$$
$$-\frac{7}{3}x = -\frac{1}{4}$$
$$x = -\frac{1}{4}\left(-\frac{3}{7}\right) = \mathbf{\frac{3}{28}}$$

18. $0.03x - x + 2 = -0.91$

$$3x - 100x + 200 = -91$$
$$-97x = -291$$
$$x = \mathbf{3}$$

19. $3x(2 - 3^0) - 7^0 = -2x(3 - 7^0) + 2$

$$3x - 1 = -4x + 2$$
$$7x = 3$$
$$x = \mathbf{\frac{3}{7}}$$

20. $\dfrac{a^{-2}}{y}\left(3a^2y - \dfrac{2y}{a^2}\right) = \dfrac{3a^{-2}a^2y}{y} - \dfrac{2a^{-2}y}{ya^2}$

$= \mathbf{3 - 2a^{-4}}$

21. $\dfrac{2x^0yp}{k}\left(\dfrac{3k}{yp} - \dfrac{2yk}{p}\right) = \dfrac{6x^0ypk}{kyp} - \dfrac{4x^0ypyk}{kp}$

$= \mathbf{6 - 4y^2}$

22. $\dfrac{2p^2a^{-2}ap^0p^4}{(2pa^{-2})^{-3}ap^0} = \dfrac{16p^6a^{-1}}{p^{-3}a^7} = \mathbf{16p^9a^{-8}}$

23. $\dfrac{xym^2m^{-4}xm}{(2x^2y)^{-3}xy^0x^{-3}y} = \dfrac{8x^2ym^{-1}}{x^{-8}y^{-2}} = \mathbf{8x^{10}y^3m^{-1}}$

24. $\dfrac{xp^{-3}}{y} - \dfrac{3y^{-1}}{x^{-1}p^3} + \dfrac{2x}{pppy} = \dfrac{x}{yp^3} - \dfrac{3x}{yp^3} + \dfrac{2x}{yp^3}$
$= \mathbf{0}$

25. $-3ka + \dfrac{3k^2a^2}{ka} - \dfrac{5a^0k}{a^{-1}} = -3ka + 3ka - 5ka$
$= \mathbf{-5ka}$

26. $-a - ax(a - x)$
$= -\left(-\frac{1}{2}\right) - \left(-\frac{1}{2}\right)\left(\frac{3}{2}\right)\left(-\frac{1}{2} - \frac{3}{2}\right)$
$= \frac{1}{2} + \frac{3}{4}(-2) = \frac{1}{2} - \frac{3}{2} = \mathbf{-1}$

27. $-a^2(b - a) = -\left(-\frac{1}{2}\right)^2\left[\frac{3}{2} - \left(-\frac{1}{2}\right)\right] = -\frac{1}{4}(2)$
$= -\frac{2}{4} = \mathbf{-\frac{1}{2}}$

28. $-2(-3 - 2^0 - 2)(-2 + 5)(-2) = -2(-6)(3)(-2)$
$= \mathbf{-72}$

29. $-\dfrac{1}{-2^0} - \dfrac{1}{-2^2} - \dfrac{1}{-2^{-2}} = 1 + \frac{1}{4} + 4 = \mathbf{5\frac{1}{4}}$

30. $|-3^0| - |-2 - 3| + (-2^0)(-2 - 5)$
$= 1 - 5 + 7 = \mathbf{3}$

Practice Set 12

a. Every point on this line is 5 units below the x-axis, so the equation is $\mathbf{y = -5}$.

b. The y-intercept is -1. The slope is negative with a rise over the run of $\frac{1}{2}$ for any triangle drawn. The equation is $\mathbf{y = -\frac{1}{2}x - 1}$.

Problem Set 12

1. If 40% were monochromatic, 60% were variegated.

$\frac{P}{100} \times of = is$

$\frac{60}{100} \times V = 2400$

$V = 2400 \times \frac{100}{60} = 4000$

Monochromatic $= 4000 - 2400 =$ **1600 vases**

2. Integers: N, $N + 1$, $N + 2$, $N + 3$

$2(N + N + 1 + N + 3) = 3(-N - 2) - 40$
$6N + 8 = -3N - 46$
$9N = -54$
$N = -6$

The desired integers are **–6, –5, –4,** and **–3.**

3. $F \times of = is$

$4\frac{1}{4} \times S = 5100$

$S = 5100 \times \frac{4}{17} = \mathbf{1200}$

4. $F \times of = is$

$2\frac{1}{5} \times N = 1$

$N = 1 \times \frac{5}{11} = \mathbf{\frac{5}{11}}$

5. $5(-N) + 25 = 8N + 90$
$-13N = 65$
$N = \mathbf{-5}$

6. If the train completed 30%, then 70% remained.

$\frac{P}{100} \times of = is$

$\frac{70}{100} \times TL = 6300$

$TL = 6300 \times \frac{100}{70} =$ **9000 miles**

7. $z + (180 - 140) + (180 - 70) = 180$
$z + 40 + 110 = 180$
$z = \mathbf{30}$

8. $(4x + 25) + (7x - 20) = 360 - 40$
$11x + 5 = 320$
$11x = 315$
$x = \mathbf{\frac{315}{11}}$

$y = \frac{1}{2}(40) = \mathbf{20}$

9. $A_{\text{Sector}} = \frac{60}{360}(\pi r^2) = 36\pi \text{ cm}^2$

$r^2 = \frac{6(36\pi) \text{ cm}^2}{\pi}$

$r = \sqrt{216} \text{ cm} = 6\sqrt{6} \text{ cm}$

Diameter $= 2r = 2(6\sqrt{6}) \text{ cm} = \mathbf{12\sqrt{6}}$ **cm**

10. Relabel angles A, B, and C as having measures of $3x$, $2x$, and x respectively.

$$3x + 2x + x = 180$$
$$6x = 180$$
$$x = 30$$

$A = \mathbf{90}$; $B = \mathbf{60}$; $C = \mathbf{30}$

11. $m + \frac{x}{c} + \frac{c}{x^2b} = \frac{mbcx^2}{bcx^2} + \frac{bx^3}{bcx^2} + \frac{c^2}{bcx^2}$

$= \boldsymbol{\frac{mbcx^2 + bx^3 + c^2}{bcx^2}}$

12. $\frac{a}{b} - \frac{3b}{a^2} - \frac{2}{abc} = \frac{a^3c}{a^2bc} - \frac{3b^2c}{a^2bc} - \frac{2a}{a^2bc}$

$= \boldsymbol{\frac{a^3c - 3b^2c - 2a}{a^2bc}}$

13. $1 + \frac{a}{b} = \frac{b}{b} + \frac{a}{b} = \boldsymbol{\frac{b + a}{b}}$

14. $c^2 = a^2 + b^2$

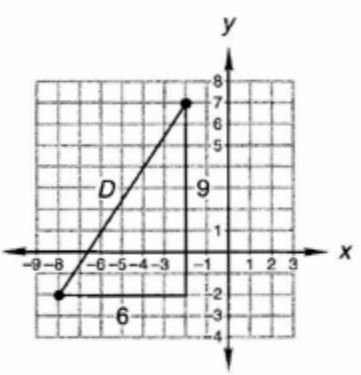
$13^2 = 5^2 + k^2$

$169 = 25 + k^2$

$144 = k^2$

$\mathbf{12} = k$

15.



$D^2 = 9^2 + 6^2$

$D^2 = 81 + 36$

$D^2 = 117$

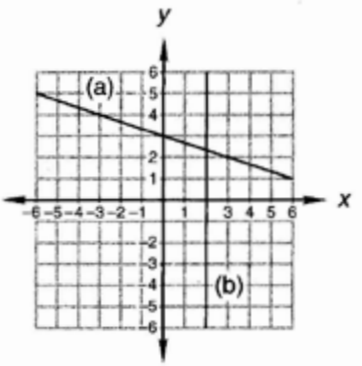
$D = \sqrt{117}$

$D = \mathbf{3\sqrt{13}}$

16. (a) $3y + x - 9 = 0$

$$3y = -x + 9$$
$$y = -\frac{1}{3}x + 3$$

(b) $x = 2$



17. (a) The y-intercept is +2. The slope is positive and the rise over the run for any triangle drawn is $\frac{1}{3}$.

$\boldsymbol{y = \frac{1}{3}x + 2}$

(b) Every point is 2 units below the x-axis.

$\boldsymbol{y = -2}$

18. $8\frac{1}{4} + 2\frac{1}{2}x = \frac{1}{8}$

$$\frac{5}{2}x = \frac{1}{8} - \frac{66}{8}$$
$$\frac{5}{2}x = -\frac{65}{8}$$
$$x = -\frac{65}{8} \cdot \frac{2}{5} = -\frac{130}{40} = \mathbf{-\frac{13}{4}}$$

19. $0.001 + 0.02x - 0.1 = 0.002x$

$$1 + 20x - 100 = 2x$$
$$18x = 99$$
$$x = \frac{11}{2} = \mathbf{5.5}$$

20. $-3(-2 - 2^0x) - (-2) - 2(-2 - 3x) = -2(x + 4)$

$$6 + 3x + 2 + 4 + 6x = -2x - 8$$
$$9x + 12 = -2x - 8$$
$$11x = -20$$
$$x = \boldsymbol{-\frac{20}{11}}$$

21. $\frac{a^{-3}x}{y^{-3}}\left(\frac{xxx^{-2}}{y^{-2}yy} - 3\right) = \frac{a^{-3}xxxx^{-2}}{y^{-3}y^{-2}yy} - \frac{3a^{-3}x}{y^{-3}}$

$= a^{-3}xy^3 - 3a^{-3}xy^3$

$= \boldsymbol{-2a^{-3}xy^3}$

22. $\frac{x^0x^{-2}}{y}\left(x^2y - \frac{2x^2y}{x^4}\right)$

$= \frac{x^0x^{-2}x^2y}{y} - \frac{2x^0x^{-2}x^2y}{yx^4} = \mathbf{1 - 2x^{-4}}$

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