376. d.The area of a rectangle is length × width.

377. b.The volume of a sphere is 4 3 times π times the radius cubed.

378. b.The area of a triangle is 1 2 times the length of the base times the length of the height.

379. b.The surface area of a sphere is four times π times the radius squared.

380. d.The area of a circle is π times the radius squared.

381. a. The volume of a cylinder is π times the radius squared, times the height of the cylinder.

382. c. The perimeter of a square is four times the length of one side.

383. c. The area of the base is π times radius squared. The area of the curved region is two times π times radius times height. Notice there is only one circular region since the storage tank would be on the ground. This area would not be painted.

384. a. The area of a square is side squared or side times side.

385. c. The circumference or distance around a circle is π times the diameter.

386. a. The perimeter of a rectangle is two times the length plus two times the width.

387. d.The volume of a cube is the length of the side cubed or the length of the side times the length of the side times the length of the side.

388. a. The perimeter of a triangle is length of side a plus length of side b plus length of side c.

389. c. The area of a rectangle is length times width. Therefore, the area of the racquetball court is equal to 40 ft times 20 ft or 800 ft2. If you chose answer d, you found the perimeter or distance around the court.

390. a. The width of the ﬁeld, 180 ft, must be divided by the width of the mower, 2 ft. The result is that he must mow across the lawn 90 times. If you chose b, you calculated as if he were mowing the length of the ﬁeld. If you chose c, you combined length and width, which would result in mowing the ﬁeld twice.

391. a. The area of the room is the sum of the area of four rectangular walls. Each wall has an area of length times width, or (8)(5.5), which equals 44 ft2. Multiply this by 4 which equals 176 ft2. If you chose c, you added 8 ft and 5.5 ft instead of multiplying.

392. c. The ceiling fan follows a circular pattern, therefore area = πr2. Area = (3.14)(25)2 = 1,962.5 in2. If you chose a, the incorrect formula you used was π2r. If you chose d, the incorrect formula you used was πd.

393. c. To ﬁnd the height of Heather’s poodle, set up the following proportion: height of the building/shadow of the building = height of the oodle/shadow of the poodle or 4 3 5 0 = 2 x .5 . Cross-multiply, 112.5 = 30x. Solve for x; 3.75 = x. If you chose d, the proportion was set up incorrectly as 4 3 5 0 = 2 x .5 .

394. b.The volume of a cylinder is πr2h. Using a height of 4 ft and radius of 10 ft, the volume of the pool is (3.14)(10)2(4) or 1,256 ft3. If you chose a, you used πdh instead of πr2h. If you chose c, you used the diameter squared instead of the radius squared.

395. b.The connection of the pole with the ground forms the right angle of a triangle. The length of the pole is a leg within the right triangle. The distance between the stake and the pole is also a leg within the right triangle. The question is to ﬁnd the length of the cable, which is the hypotenuse. Using the Pythagorean theorem: 242 + 102 = c2; 576 + 100 = c2; 676 = c2; 26 = c. If you chose a, you thought the hypotenuse, rather than a leg, was 24 ft.

396. b.The distance around the room is 2(12) + 2(13) or 50 ft. Each roll of border is 5(3) or 15 ft. By dividing the total distance, 50 ft, by the length of each roll, 15 ft, we ﬁnd we need 3.33 rolls. Since a roll cannot be subdivided, 4 rolls will be needed.

397. b.If the diameter of a sphere is 6 inches, the radius is 3 inches. The radius of a circle is half the diameter. Using the radius of 3 inches, surface area equals (4)(3.14)(3)2 or 113.04 in2. Rounding this to the nearest inch is 113 in2. If you chose a, you used the diameter rather than the radius. If you chose c, you did not square the radius. If you chose d, you omitted the value 4 from the formula for the surface area of a sphere.

398. d.The area of a rectangle is length times width. Using the dimensions described, area = (11)(13) or 143 ft2.

399. b.To ﬁnd how far Shannon will travel, set up the following proportion: 1 1 4 i m nc il h es = 1 x 7 m in i c l h es es . Cross multiply, x = 238 miles.

400. a. The circumference of a circle is πd. Using the diameter of 10 inches, the circumference is equal to (3.14)(10) or 31.4 inches. If you chose b, you found the area of a circle. If you chose c, you mistakenly used πr for circumference rather than 2πr. If you chose d, you used the diameter rather than the radius.

401. c. The circumference of a circle is πd. Since 10 ft represents the radius, the diameter is 20 feet. The diameter of a circle is twice the radius. Therefore, the circumference is (3.14)(20) or 62.8 ft. If you chose a, you used πr rather than 2πr. If you chose b, you found the area rather than circumference.

402. a. The area of a triangle is 1 2 (base)(height). Using the dimensions given, area = 1 2 (30)(83) or 1,245 ft2. If you chose b, you assigned 83 ft as the value of the hypotenuse rather than a leg. If you chose c, you found the perimeter of the triangular sail. If you chose d, you omitted 1 2 from the formula.

403. b.The volume of a sphere is 4 3 πr3. Using the dimensions given, volume = 4 3 (3.14)(4)3 or 267.9. Rounding this answer to the nearest inch is 268 in3. If you chose a, you found the surface area rather than volume. If you chose c, you miscalculated surface area by using the diameter.

404. c. The area of a circle is πr2. The diameter = 42 in, radius = 42 ÷ 2 = 21 in, so (3.14)(21)2 = 1,384.74 in2. Rounding to the nearest inch, the answer is 1,385 in2. If you chose a, you rounded the ﬁnal answer incorrectly. If you chose d, you used the diameter rather than the radius.

405. d.To ﬁnd the volume of a sphere, use the formula Volume = 4 3 πr3. Volume = 4 3 (3.14)(1.5)3 = 14.13 in3. If you chose a, you squared the radius instead of cubing the radius. If you chose b, you cubed the diameter instead of the radius. If you chose c, you found the surface area of the sphere, not the volume.

406. c. The ladder forms a right triangle with the building. The length of the ladder is the hypotenuse and the distance from the base of the building is a leg. The question asks you to solve for the remaining leg of the triangle, or how far up the building the ladder will reach. Using the Pythagorean theorem: 92 + b2 = 152; 81 + b2 = 225; 81 b2 81 225 81; b2 = 144; b = 12.

407. b.The volume of a rectangular solid is length times width times depth. Using the dimensions in the question, volume = (22)(5)(5) or 550 in3. If you chose c, you found the surface area of the box.

408. b.A minute hand moves 180 degrees in 30 minutes. Using the following proportion: 1 3 8 0 0 m d i e n g u r t e e e s s = 2 x 0 d m eg in r u ee te s s . Cross-multiply, 30x = 3,600. Solve for x; x = 120 degrees.

409. a. The planes are traveling perpendicular to each other. The course they are traveling forms the legs of a right triangle. The question requires us to ﬁnd the distance between the planes or the length of the hypotenuse. Using the Pythagorean theorem 702 + 1682 = c2; 4,900 + 28,224 = c2; 33,124 = c2; c= 182 miles. If you chose c, you assigned the hypotenuse the value of 168 miles and solved for a leg rather than the hypotenuse. If you chose d, you added the legs together rather than using the Pythagorean theorem.

410. d.The area of a small pizza is 78.5 in2. The question requires us to ﬁnd the diameter of the pizza in order to select the most appropriate box. Area is equal to πr2. Therefore, 78.5 = πr2; divide by π(3.14); 78.5 ÷3.14 = πr2 ÷3.14; 25 = r2; 5 = r. The diameter is twice the radius or 10 inches. Therefore, the box is also 10 inches.

411. d.The area of Stuckeyburg can be found by dividing the region into a rectangle and a triangle. Find the area of the rectangle (A = lw) and add the area of the triangle (1 2 bh) for the total area of the region. Referring to the diagram, the area of the rectangle is (10)(8) = 80 miles2. The area of the triangle is 1 2 (8)(3) = 12 miles2. The sum of the two regions is 80 miles2 + 12 miles2 = 92 miles2. If you chose a, you found the perimeter. If you chose b, you found the area of the rectangular region but did not include the triangular region.

412. b.The area of a rectangle is length times width. Using the formula 990 yd2 = (l)(22), solve for l by dividing both sides by 22; l = 45 yards.

413. b.To ﬁnd the area of the matting, subtract the area of the print from the area of the frame. The area of the print is found using πr2 or (3.14)(7)2 which equals 153.86 in2. The area of the frame is length of side times length of side or (18)(18), which equals 324 in2. The difference, 324 in2 − 153.86 in2 or 170.14 in2, is the area of the matting. If you chose c, you mistakenly used the formula for the circumference of a circle, 2πr, instead of the area of a circle, πr2.

414. a. The ribbon will travel the length (10 in) twice, the width (8 in) twice and the height (4 in) four times. Adding up these distances will determine the total amount of ribbon needed. 10 in + 10 in + 8 in + 8 in + 4 in + 4 in + 4 in + 4 in = 52 inches of ribbon. If you chose b, you missed two sides of 4 inches. If you chose d, you calculated the volume of the box. 10 miles 8 miles = base 3 miles = height 10 miles, 9 miles, A = lw, A = bh 13 – 10 } }

415. d.To ﬁnd the area of the skirt, ﬁnd the area of the outer circle minus the area of the inner circle. The area of the outer circle is π (3.5)2 or 38.465 in2. The area of the inner circle is π (.5)2 or .785 in2. The difference is 38.465 − .785 or 37.68 ft2. The answer, rounded to the nearest foot, is 38 ft2. If you chose a, you rounded to the nearest tenth of a foot. If you chose b, you miscalculated the radius of the outer circle as being 3 feet instead of 3.5 feet.

416. c. Since the tiles are measured in inches, convert the area of the ﬂoor to inches as well. The length of the ﬂoor is 9 ft × 12 in per foot = 108 in. The width of the ﬂoor is 11 ft × 12 in per foot = 132 in. The formula for area of a rectangle is length × width. Therefore, the area of the kitchen ﬂoor is 108 in × 132 in or 14,256 in2. The area of one tile is 6 in × 6 in or 36 in2. Finally, divide the total number of square inches by 36 in2 or 14,256 in2 divided by 36 in2 = 396 tiles.

417. a. If a framed print is enclosed by a 2-inch matting, the print is 4 in less in length and height. Therefore, the picture is 32 in by 18 in. These measurements along with the diagonal form a right triangle. Using the Pythagorean theorem, solve for the diagonal. 322 + 182 = c2; 1,024 + 324 = c2; 1,348 = c2; 36.7 = c. If you chose b, you reduced the print 2 inches less than the frame in length and height rather than 4 inches.

418. a. To ﬁnd the height of the building set up the following proportion: = or 2 2 0 5 = 5 x 0 . Cross-multiply: 1,000 = 25x. Solve for x by dividing both sides by 25; x = 40. If you chose b, you set up the proportion incorrectly as 2 2 0 5 = 5 x 0 . If you chose c, you set up the proportion incorrectly as 5 2 0 5 = 2 x 0 .

419. c. The surface area of the box is the sum of the areas of all six sides. Two sides are 20 in by 18 in or (20)(18) = 360 in2. Two sides are 18 in by 4 in or (18)(4) = 72 in2. The last two sides are 20 in by 4 in or (20)(4) = 80 in2. Adding up all six sides: 360 in2 + 360 in2 + 77 in2 + 77 in2 + 80 in2 + 80 in2 = 1,024 in2, is the total area. If you chose a, you did not double all sides. If you chose b, you calculated the volume of the box.

420. d.The area of the walkway is equal to the entire area (area of the walkway and pool) minus the area of the pool.The area of the entire region is length times width. Since the pool is 20 feet wide and the walkway adds 4 feet onto each side, the width of the rectangle formed by the walkway height of the building shadow of the building height of the light post shadow of light post and pool is 20 + 4 + 4 = 28 feet. Since the pool is 40 feet long and the walkway adds 4 feet onto each side, the length of the rectangle formed by the walkway and pool is 40 + 4 + 4 = 48 feet. Therefore, the area of the walkway and pool is (28)(48) = 1,344 ft2. The area of the pool is (20)(40) = 800 ft2. 1,344 ft2 – 800 ft2 = 544 ft2. If you chose c, you extended the entire area’s length and width by 4 feet instead of 8 feet.

421. c. The area described as section A is a trapezoid. The formula for the area of a trapezoid is 1 2 h(b1 + b2). The height of the trapezoid is 1 inch, b1 is 6 inches, and b2 is 8 inches. Using these dimensions, area = 1 2 (1)(6 + 8) or 7 in2. If you chose b, you used a height of 2 inches rather than 1 inch. If you chose d, you found the area of section B or D.

422. b.To ﬁnd the total area, add the area of region A plus the area of region B plus the area of region C. The area of region A is length times width or (100)(40) = 4,000 m2. Area of region B is 1 2 bh or 1 2 (40)(30) = 600 m2. The area of region C is 1 2 bh or 1 2 (30)(40) = 600 m2. The combined area is the sum of the previous areas or 4,000 + 600 + 600 = 5,200 m2. If you chose a, you miscalculated the area of a triangle as bh instead of 1 2 bh. If you chose c, you found only the area of the rectangle. If you chose d, you found the area of the rectangle and only one of the triangles.

423. c. To ﬁnd the perimeter, we must know the length of all sides. According to the diagram, we must ﬁnd the length of the hypotenuse for the triangular regions B and C. Using the Pythagorean theorem for triangular region B, 302 + 402 = c2; 900 + 1,600 = c2; 2,500 = c2; 50 m = c. The hypotenuse for triangular region C is also 50 m since the legs are 30 m and 40 m as well. Now adding the length of all sides, 40 m + 100 m + 30 m + 50 m + 30 m + 50 m + 60 m = 360 m, the perimeter of the plot of land. If you chose a, you did not calculate in the hypotenuse on either triangle. If you chose b, you miscalculated the hypotenuse as having a length of 40 m. If you chose d, you miscalculated the hypotenuse as having a length of 30 m.

424. d.The 18 ft pole is perpendicular to the ground forming the right angle of a triangle. The 20 ft guy wire represents the hypotenuse. The task is to ﬁnd the length of the remaining leg in the triangle. Using the Pythagorean theorem: 182 + b2 = 202; 324 + b2 = 400; b2 = 76; b = 76 or 219 . If you chose a, you did not take the square root.

425. c. ABD is similar to ECD. Using this fact, the following proportion is true: D E C E = D A B A or 4 3 0 2 = (40 6 0 x) . Cross-multiply, 2,400 = 32(40 + x); 2,400 = 1,280 + 32x. Subtract 1,280; 1,120 = 32x; divide by 32; x = 35 feet.

426. a. The area of the front cover is length times width or (8)(11) = 88 in2. The rear cover is the same as the front, 88 in2. The area of the binding is length times width or (1.5)(11) = 16.5 in2. The extension inside the front cover is length times width or (2)(11) = 22 in2. The extension inside the rear cover is also 22 in2. The total area is the sum of all previous areas or 88 in2 + 88 in2 + 16.5 in2 + 22 in2 + 22 in2 or 236.5 in2. If you chose b, you did not calculate the extensions inside the front and rear covers. If you chose c, you miscalculated the area of the binding as (1.5)(8) and omitted the extensions inside the front and rear covers. If you chose d, you miscalculated the area of the binding as (1.5)(8) only.

427. a. To ﬁnd the area of the rectangular region, multiply length times width or (30)(70), which equals 2,100 in2. To ﬁnd the area of the semi-circle, multiply 1 2 times πr2 or 1 2 π(15)2 which equals 353.25 in2. Add the two areas together, 2,100 plus 353.25 or 2,453.3, rounded to the nearest tenth, for the area of the entire window. If you chose b, you included the area of a circle, not a semi-circle.

428. b. ACE and BCD are similar triangles. Using this fact, the following proportion is true: B C D B = C A A E or 1 5 0 5 0 = 15 x 0 . Cross-multiply, 100x = 8,250. Divide by 100 to solve for x; x = 82.5 yards. If you chose a or c, you set up the proportion incorrectly.

429. b.The question requires us to ﬁnd the distance around the semi-circle. This distance will then be added to the distance traveled before entering the roundabout, 200 m, and the distance traveled after exiting the roundabout, 160 m. According to the diagram, the diameter of the roundabout is 160 m. The distance or circumference of half a circle is 1 2 πd, 1 2 (3.14)(160) or 251.2 m. The total distance or sum is 200 m + 160 m + 251.2 m = 611.2 m. If you chose a, you included the distance around the entire circle. If you chose c, you found the distance around the circle. If you chose d, you did not include the distance after exiting the circle, 160 m.

430. d.The boat is the triangle’s right angle. The distance between the balloon and the boat is 108 meters, one leg. The distance between the boat and the land, 144 meters, is the second leg. The distance between the balloon and the land, which is what we are ﬁnding, is the hypotenuse. Using the Pythagorean theorem: 1082 + 1442 = c2; 11,664 + 20,736 = c2; 32,400 = c2; c = 180 m.

431. d.Since the monitor is square, the diagonal and length of the sides of the monitor form an isosceles right triangle. The question requires one to ﬁnd the length of one leg to ﬁnd the area. Using the Pythagorean theorem: s2 + s2 = 192; 2s2 = 361. Divide by 2; s2 = 180.5. Find the square root; s = 13.44. To ﬁnd the area of a square, area = s2. Therefore, area = (13.44)2 or 180.5 in2. If you chose a, you simply squared the diagonal or 192 = 361.

432. b.To ﬁnd the surface area of a cylinder, use the following formula: surface area = 2πr2 + πdh. Therefore, the surface area = 2(3.14)(10)2 + (3.14)(20)(40) or 3,140 ft2. If you chose b, you found the surface area of the circular top and forgot about the bottom of the water tower. However, the bottom of the tower would need painting since the tank is elevated.

433. d.Using the concept of similar triangles, CDB is similar to CEA, so set up the following proportion: 2 2 5 0 = (x 1 + 2 2 5 0) . Cross-multiply, 25x + 500 = 2,500. Subtract 500; 25x = 2,000; Divide by 25; x = 80. If you chose b, the proportion was set up incorrectly as 2 2 5 0 = (x 1 + 2 2 5 0) .

434. a. To ﬁnd the total surface area of the silo, add the surface area of the cylinder to the surface area of 1 2 of the sphere. To ﬁnd the area of the cylinder, use the formula πhd or (3.14)(50)(16) which equals 2,512 ft2. The area of 1 2 a sphere is (1 2 )(4)πr2. Using a radius of 8 ft, the area is (1 2 )(4)π(8)2 = 401.92 ft2. Adding the area of the cylinder plus 1 2 the sphere is 2,512 + 401.92 = 2,913.92 ft2. If you chose b, your miscalculation was in ﬁnding the area of 1 2 the sphere. You used the diameter rather than the radius. If you chose d, you found the surface area of the entire sphere, not just half.

435. c. The height of the monument is the sum of BE plus EG . Therefore, the height is 152.5 + 17.6 or 170.1 meters. If you chose a, you added BE + EF . If you chose b, you added BE + BC .

436. a. The surface area of the monument is the sum of 4 sides of a trapezoidal shape plus 4 sides of a triangular shape. The trapezoid DFCA has a height of 152.5m (BE ), b1 = 33.6 (AC ), and b2 = 10.5 (DF ). The area is 1 2 h(b1 + b2) or 1 2 (152.5)(33.6 + 10.5) which equals 3,362.625 m2. The triangle DGF has b = 10.5 and h = 17.6. The area is 1 2 bh or 1 2 (10.5)(17.6) which equals 92.4 m2. The sum of 4 trapezoidal regions, (4)(3,362.625) = 13,450.5 m2, plus 4 triangular regions, 4(92.4) = 369.6 m2, is 13,820.1 m2. Rounding this answer to the nearest meter is 13,820 m2. If you chose b, you found the area of the trapezoidal regions only. If you chose c, you found the area of one trapezoidal region and one triangular region. If you chose d, you found the area of 4 trapezoidal regions and one triangular region.

437. c. The volume of a rectangular solid is length times width times height. First, calculate what the volume would be if the entire pool had a depth of 10 ft. The volume would be (10)(30)(15) or 4,500 ft3. Now subtract the area under the sloped plane, a triangular solid. The volume of the region is 1 2 (base)(height)(depth) or 1 2 (7)(30)(15) or 1,575 ft3. Subtract: 4,500 ft3 minus 1,575 ft3 results in 2,925 ft3 as the volume of the pool. If you chose a, this is the volume of the triangular solid under the sloped plane in the pool. If you chose b, you did not calculate the slope of the pool, but rather a pool that is consistently 10 feet deep. 10 ft 30 ft 30 ft 15 ft 3 ft 7 ft

438. a. Two parallel lines cut by a transversal form alternate interior angles that are congruent. The two parallel lines are formed by the mirrors, and the path of light is the transversal. Therefore, ∠2 and ∠3 are alternate interior angles that are congruent. If ∠2 measures 50°, ∠3 is also 50°. If you chose b, your mistake was assuming ∠2 and ∠3 are complementary angles. If you chose c, your mistake was assuming ∠2 and ∠3 are supplementary angles.

439. b.Knowing that ∠4 + ∠3 + the right angle placed between ∠4 and ∠3, equals 180 and the fact that ∠3 = 50, we simply subtract 180 − 90 − 50, which equals 40. If you chose a, you assumed that ∠3 and ∠4 are vertical angles. If you chose c, you assumed that ∠3 and ∠4 are supplementary.

440. c. The sum of the measures of the angles of a triangle is 180. The question is asking us to solve for x. The equation is x + x + 3x + 10 = 180. Simplifying the equation, 5x + 10 = 180. Subtract 10 from each side; 5x = 170. Divide each side by 5; x = 34. If you chose a, you solved for the vertex angle. If you chose b, you wrote the original equation incorrectly as x + 3x + 10 = 180. If you chose d, you wrote the original equation incorrectly as x + x + 3x + 10 = 90.

441. d.Since we solved for x in the previous question, simply substitute x = 34 into the equation for the vertex angle, 3x + 10. The result is 112°. If you chose a, you solved for the base angle. If you choice b, the original equation was written incorrectly as x + x + 3x + 10 = 90.

442. a. Opposite angles of a parallelogram are equal in measure. Using this fact, ∠A = ∠C or 5x + 2 = 6x − 4. Subtract 5x from both sides; 2 = x − 4. Add 4 to both sides; 6 = x. Now substitute x = 6 into the expression for ∠A; 6(6) − 4 = 36 − 4 or 32. If you chose b, you solved for x, not the angle. If you chose c, you assumed the angles were supplementary. If you chose d, you assumed the angles were complementary.

443. a. The two bases of the trapezoid are represented by x and 3x. The nonparallel sides are each x + 5. Setting up the equation for the perimeter will allow us to solve for x; x + 3x + x + 5 + x + 5 = 40. Simplify to 6x + 10 = 40. Subtract 10 from both sides; 6x = 30. Divide both sides by 6; x = 5. The longer base is represented by 3x. Using substitution, 3x or (3)(5) equals 15, the longer base. If you chose b, you solved for the shorter base. If you chose c, you solved for the nonparallel side. If you chose d, the original equation was incorrect, x + x + 5 + 3x = 40.

444. a. The sum of the measures of the angles of a triangle is 180. Using this information, we can write the equation 2x + 15 + x + 20 + 3x + 25 = 180. Simplify the equation; 6x + 60 = 180. Subtract 60 from both sides; 6x = 120. Divide both sides by 6; x = 20. Now substitute 20 for x in each expression to ﬁnd the smallest angle. The smallest angle is found using the expression x + 20; 20 + 20 = 40. If you chose b, this was the largest angle within the triangle. If you chose c, the original equation was incorrectly written as 2x + 15 + x + 20 + 3x + 25 = 90. If you chose d, this was the angle that lies numerically between the smallest and largest angle measurements.

445. b.AB and AD are the legs of a right triangle. DB is the hypotenuse and BX is equal to 1 2 of DB . Solving for the hypotenuse, we use the Pythagorean theorem, a2 + b2 = c2; 102 + 62 = DB 2; 100 + 36 = DB 2; 136 = DB 2. DB = 11.66; 1 2 of DB = 5.8. If you chose a, you assigned 10 as the length of the hypotenuse. If you chose d, the initial error was the same as choice a. In addition, you solved for DB and not 1 2 DB .

446. b.The perimeter of a parallelogram is the sum of the lengths of all four sides. Using this information and the fact that opposite sides of a parallelogram are equal, we can write the following equation: x x 3x 2 2 + (3x 2 + 2) = 32. Simplify to 2x + 3x + 2 = 32. Simplify again; 5x + 2 = 32. Subtract 2 from both sides; 5x = 30. Divide both sides by 5; x = 6. The longer base is represented by (3x 2 + 2) . Using substitution, (3(6 2 ) + 2) equals 10. If you chose c, you solved for the shorter side.

447. b.To ﬁnd the width of the piece of sheetrock that can ﬁt through the door, we recognize it to be equal to the length of the diagonal of the door frame. If the height of the door is 6 ft 6 in, this is equivalent to 78 inches. Using the Pythagorean theorem, a = 78 and b = 36, we will solve for c. (78)2 + (36)2 = c2. Simplify: 6,084 + 1,296 = c2; 7,380 = c2. Take the square root of both sides, c = 86. If you chose a, you added 78 + 36. If you chose c, you rounded incorrectly. If you chose d, you assigned 78 inches as the hypotenuse, c.

448. d.To ﬁnd the length of the rectangle, we will use the Pythagorean theorem. The width, a, is 20. The diagonal, c, is x + 8. The length, b, is x; a2 + b2 = c2; 202 + x2 = (x + 8)2. After multiplying the two binomials (using FOIL), 400 + x2 = x2 + 16x + 64. Subtract x2 from both sides; 400 = 16x + 64. Subtract 64 from both sides; 336 = 16x. Divide both sides by 16; 21 = x. If you chose a, you incorrectly determined the diagonal to be 28.

449. b.Two angles are complementary if their sum is 90°. Using this fact, we can establish the following equation: 7x + 8x = 90. Simplify; 15x = 90. Divide both sides of the equation by 15; x = 6. The smallest angle is represented by 7x. Therefore 7x = 7(6) or 42, the smallest angle measurement. If you chose a, the original equation was set equal to 180 rather than 90. If you chose c, you solved for the largest angle. If you chose d, the original equation was set equal to 180 and you solved for the largest angle as well.

450. d.Adjacent angles in a parallelogram are supplementary. ∠A and ∠D are adjacent angles. Therefore, ∠A + ∠D = 180; 3x + 10 + 2x + 30 = 180. Simplifying, 5x + 40 = 180. Subtract 40 from both sides, 5x = 140. Divide both sides by 5; x = 28. ∠A = 3x + 10 or 3(28) + 10 which equals 94. If you chose a, you assumed ∠A = ∠D. If you chose b, you assumed ∠A + ∠D = 90. If you chose c, you solved for ∠D instead of ∠A.

451. b.The sum of the measures of the exterior angles of any polygon is 360°. Therefore, if the sum of four of the ﬁve angles equals 325, to ﬁnd the ﬁfth simply subtract 325 from 360, which equals 35. If you chose a, you divided 325 by 4, assuming all four angles are equal in measure and assigned this value to the ﬁfth angle, ∠E.

452. c. This problem requires two steps. First, determine the base and height of the triangle. Second, determine the area of the triangle. To determine the base and height we will use the equation x + 4x = 95. Simplifying, 5x = 95. Divide both sides by 5, x = 19. By substitution, the height is 19 and the base is 4(19) or 76. The area of the triangle is found by using the formula area = 1 2 base × height. Therefore, the area = 1 2 (76)(19) or 722 cm2. If you chose a, the area formula was incorrect. Area = 1 2 base × height, not base × height. If you chose b, the original equation x + 4x = 95 was simpliﬁed incorrectly as 4x2 = 95.

453. c. To solve for the height of the structure, solve the following proportion: 10 x 0 = 16 8 0 . Cross-multiply, 8x = 16,000. Divide both sides by 8; x = 2,000. If you chose b or d, you made a decimal error.

454. c. In parallelogram ABCD, ∠2 is equal in measurement to ∠5. ∠2 and ∠5 are alternate interior angles, which are congruent. If ∠B is 120, then ∠B + ∠5 + ∠4 = 180. Adjacent angles in a parallelogram are supplementary. Therefore, 40 + 120 + x = 180. Simplifying, 160 + x = 180. Subtract 160 from both sides; x = 20. If you chose a, you assumed ∠4 + ∠5 = 90. If you chose d, you assumed ∠4 is 1 2 (∠4 + ∠5).

455. a. There are two ways of solving this problem. The ﬁrst method requires a linear equation with one variable. The second method requires a system of equations with two variables. Let the length of the rectangle equal x. Let the width of the rectangle equal x + 8. Together they measure 130 yards. Therefore, x + x + 8 = 130. Simplify, 2x + 8 = 130. Subtract 8 from both sides, 2x = 122. Divide both sides by 2; x = 61. The length of the rectangle is 61, and the width of the rectangle is 61 + 8 or 69; 61 × 69 = 4,209. The second method of choice is to develop a system of equations using x and y. Let x = the length of the rectangle and let y = the width of the rectangle. Since the sum of the length and width of the rectangle is 130, we have the equation x + y = 130. The difference is 8, so we have the equation x − y = 8. If we add the two equations vertically, we get 2x = 122. Divide both sides by 2: x = 61. The length of the rectangle is 61. Substitute 61 into either equation; 61 + y = 130. Subtract 61 from both sides, giving you y = 130 − 61 = 69. To ﬁnd the area of the rectangle, we use the formula length × width or (61)(69) = 4,209. If you chose b, you added 61 to 69 rather than multiplied. If you chose c, the length is 61 but the width was decreased by 8 to 53.

456. d.The volume of a sphere is found by using the formula 4 3 πr3. Since the volume is 288π cm3 and we are asked to ﬁnd the radius, we will set up the following equation: 4 3 πr3 = 288π. To solve for r, multiply both sides by 3; 4πr3 = 864π. Divide both sides by π; 4r3 = 864. Divide both sides by 4; r3 = 216. Take the cube root of both sides; r = 6. If you chose a, the formula for volume of a sphere was incorrect; 1 3 πr3 was used instead of 4 3 πr3. If you chose c, near the end of calculations you mistakenly took the square root of 216 rather than the cube root.

457. d.∠ABE and ∠CBD are vertical angles that are equal in measurement. Solve the following equation for x: 4x + 5 = 7x − 10. Subtract 4x from both sides; 5 = 3x − 10. Add 10 to both sides; 15 = 3x. Divide both sides by 3; 5 = x or x = 5. To solve for ∠ABE substitute x = 5 into the expression 4x + 5 and simplify; 4(5) + 5 equals 20 + 5 or 25. ∠ABE equals 25°. If you chose a, you solved for ∠ABC or ∠EBD. If you chose b, you assumed the angles were supplementary and set the sum of the two angles equal to 180. If you chose c, it was the same error as choice b.

458. b.If two angles are complementary, the sum of the measurement of the angles is 90°. ∠1 is represented by x. ∠2 is represented by 4x. Solve the following equation for x: x + 4x = 90. Simplify; 5x = 90. Divide both sides by 5; x = 18. The larger angle is 4x or 4(18), which equals 72°. If you chose a, the original equation was set equal to 180 rather than 90 and you solved for the smaller angle. If you chose c, the original equation was set equal to 180 rather than 90, and you solved for the larger angle. If you chose d, you solved the original equation correctly; however, you solved for the smaller of the two angles.

459. d.To ﬁnd how far the wheel will travel, ﬁnd the circumference of the wheel multiplied by 2. The formula for the circumference of the wheel is πd. Since the diameter of the wheel is 25 inches, the circumference of the wheel is 25π. Multiply this by 2, (2)(25π) or 50π. Finally, substitute 3.14 for π; 50(3.14) = 157 inches, the distance the wheel traveled in two turns. If you chose a, you used the formula for area of a circle rather than circumference. If you chose b, the distance traveled was one rotation, not two.

460. a. If two angles are supplementary, the sum of the measurement of the angles is 180°. ∠1 is represented by x. ∠2 is represented by 2x + 30. Solve the following equation for x; x + 2x + 30 = 180. Simplify; 3x + 30 = 180. Subtract 30 from both sides; 3x = 150. Divide both sides by 3; x = 50. The larger angle is 2x + 30 or 2(50) + 30, which equals 130°. If you chose b, the equation was set equal to 90 rather than 180 and you solved for the smaller angle. If you chose c, x was solved for correctly; however, this was the smaller of the two angles. If you chose d, the original equation was set equal to 90 rather than 180, yet you continued to solve for the larger angle.

461. d.∠AED and ∠BEC are vertical angles that are equal in measurement. Solve the following equation for x: 5x − 36 = 2x + 9. Subtract 2x from both sides of the equation; 3x − 36 = 9. Add 36 to both sides of the equation; 3x = 45. Divide both sides by 3; x = 15. To solve for ∠AED substitute x = 15 into the expression 2x + 9 and simplify. 2(15) + 9 equals 39. ∠AED equals 39°. If you chose a, you solved for the wrong angle, either ∠AEB or ∠DEC. If you chose b, you assumed the angles were supplementary and set the sum of the angles equal to 180°. If you chose c, it was the same error as choice b.

462. a. The sum of the measures of the angles of a triangle is 180°. Using this fact we can establish the following equation: 3x + 4x + 5x = 180. Simplifying; 12x = 180. Divide both sides by 12; x = 15. The largest angle is represented by 5x. Therefore, 5x, or 5(15), equals 75, the measure of the largest angle. If you chose b, the original equation was set equal to 90 rather than 180. If you chose c, this was the smallest angle within the triangle. If you chose d, this was the angle whose measurement lies between the smallest and largest angles.

463. c. The widest piece of mail will be equal to the length of the diagonal of the mailbox. The width, 4.5 in, will be a leg of the right triangle. The height, 5 in, will be another leg of the right triangle. We will solve for the hypotenuse, which is the diagonal of the mailbox, using the Pythagorean theorem; a2 + b2 = c2 or 4.52 + 52 = c2. Solve for c, 20.25 + 25 = c2; 45.25 = c2; c = 6.7. If you chose a, you assigned the legs the values of 4.5 and 10; 10 is incorrect. If you chose b, you assigned the legs the values of 5 and 10. Again, 10 is incorrect.

464. d.To ﬁnd the area of the cross section of pipe, we must ﬁnd the area of the outer circle minus the area of the inner circle. To ﬁnd the area of the outer circle, we will use the formula area = πr2. The outer circle has a diameter of 4(3 + 1 2 + 1 2 ) and a radius of 2; therefore, the area = π22 or 4π. The inner circle has a radius of 1.5; therefore, the area = π(1.5)2 or 2.25π. The difference, 4π−2.25π or 1.75π is the area of the cross section of pipe. If you chose a, you used the outer circle’s radius of 3 and the inner circle’s radius of 1 2 . If you chose b you used the outer circle’s radius of 7 2 and the inner circle’s radius of 3. If you chose c, you used the outer radius of 4 and the inner radius of 3.

465. a. To ﬁnd the volume of the pipe with a known cross section and length of 18 inches, simply multiply the area of the cross section times the length of the pipe. The area of the cross section obtained from the previous question was 1.75π in2. The length is 18 inches. Therefore, the volume is 1.75 in2 times 18 inches or 31.5π in3. If you chose b, you multiplied choice c from the previous question by 18. If you chose c, you multiplied choice a from the previous question by 18. If you chose d, you multiplied choice b from the previous question by 18.

466. c. Sketching an illustration would be helpful for this problem. Observe that point A is the starting point and point B is the ending point. After sketching the four directions, we connect point A to point B. We can add to the illustration the total distance traveled north as well as the total distance traveled east. This forms a right triangle, given the distance of both legs, with the hypotenuse to be solved. Using the Pythagorean theorem, a2 + b2 = c2, or 82 + 152 = c2; 64 + 225 = c2; 289 = c2; c = 17. If you chose a, you mistakenly traveled 4 miles due east instead of due west. If you chose b, you labeled the triangle incorrectly by assigning 15 to the hypotenuse rather than a leg. If you chose d, you solved the problem correctly but chose the wrong heading, northwest instead of northeast. 5 4 10 8 15 B C A 12

467. b.The area of the shaded region is the area of a rectangle, 22 by 12, minus the area of a circle with a diameter of 12. The area of the rectangle is (22)(12) = 264. The area of a circle with diameter 12 and a radius of 6, is π(6)2 = 36π. The area of the shaded region is 264 − 36π. If you chose a, the formula for area of a circle was incorrect, 1 2 πr2. If you chose c, the formula for area of a circle was incorrect, πd. If you chose d, this was the reverse of choice a—area of the circle minus area of the rectangle.

468. c. To ﬁnd the area of the label, we will use the formula for the surface area of a cylinder, area = πdh, which excludes the top and bottom. Substituting d = 20 and h = 45, the area of the label is π(20)(45) or 900π cm2. If you chose a, you used an incorrect formula for area, area = πrh. If you chose b, you used an incorrect formula for area, area = πr2h.

469. c. The sum of the measurement of ∠AEB and ∠BEC is 180°. Solve the following equation for x: 5x + 40 + x + 20 = 180. Simplify; 6x + 60 = 180. Subtract 60 from both sides; 6x = 120. Divide both sides by 6; x = 20. ∠DEC and ∠AEB are vertical angles that are equal in measurement. Therefore, if we ﬁnd the measurement of ∠AEB, we also know the measure of ∠DEC. To solve for ∠AEB, substitute x = 20 into the equation 5x + 40 or 5(20) + 40, which equals 140°. ∠DEC is also 140°. If you chose a, you solved for ∠BEC. If you chose b or d, the original equation was set equal to 90 rather than 180. In choice b, you then solved for ∠BEC. In choice d, you solved for ∠DEC.

470. d.Two parallel lines cut by a transversal form corresponding angles that are congruent or equal in measurement. ∠BAE is corresponding to ∠CFE. Therefore ∠CFE = 46°. ∠CDF is corresponding to ∠BEF. Therefore, ∠BEF = 52°. The sum of the measures of the angles within a triangle is 180°. ∠CFE + ∠BEF + ∠FGE = 180°. Using substitution, 46 + 52 + ∠FGE = 180. Simplify; 98 + ∠FGE = 180. Subtract 98 from both sides; ∠FGE = 82°. ∠FGE and ∠CGE are supplementary angles. If two angles are supplementary, the sum of their measurements equals 12 22 180°. Therefore, ∠FGE + ∠CGE = 180. Using substitution, 82 + ∠CGE = 180. Subtract 82 from both sides; ∠CGE = 98°. If you chose a, you solved for ∠CFE. If you chose b, you solved for ∠BEF. If you chose c, you solved for ∠FGE.

471. b.To ﬁnd the area of the shaded region, we must ﬁnd the area of the circle minus the area of the rectangle. The formula for the area of a circle is πr2. The radius is 1 2 BC or 1 2 (10), which is 5. The area of the circle is π(52) or 25π. The formula for the area of a rectangle is length × width. Using the fact that the rectangle is divided into two triangles with width of 6 and hypotenuse of 10, and using the Pythagorean theorem, we will ﬁnd the length; a2 + b2 = c2; a2 + 62 = 102; a2 + 36 = 100; a2 = 64; a = 8. The area of the rectangle is length × width or 6 × 8 = 48. Finally, to answer the question, the area of the shaded region is the area of the circle − the area of the rectangle, or 25π−48. If you chose a, the error was in the use of the Pythagorean theorem, 62 + 102 = c2. If you chose c, the error was in ﬁnding the area of the rectangle. If you chose d, you used the wrong formula for area of a circle, πd2.

472. b.The area of the shaded region is equal to the area of the square minus the area of the two semicircles. The area of the square is s2 or 42, which equals 16. The area of the two semicircles is equal to the area of one circle. Area = πr2 or π(2)2 or 4π. Therefore, the area of the shaded region is 16 − 4π. If you chose a, you calculated the area of the square incorrectly as 8. If you chose c, you used an incorrect formula for the area of two semicircles, 1 2 πr2.

473. d.To solve for the length of the belt, begin with the distance from the center of each pulley, 3 ft, and multiply by 2; (3)(2) or 6 ft. Secondly, you need to know that the distance of two semicircles with the same radius is equivalent to the circumference of one circle. Therefore C = πd or (12π) inches. Since the units are in feet, and not inches, convert (12π) inches to feet or (1π)ft. Now add these two values together, (6 + 1π)ft, to determine the length of the belt around the pulleys. If you chose a or b, you used an incorrect formula for circumference of a circle. Recall: Circumference = πd. If you chose c, you forgot to convert the unit from inches to feet.

474. d.To ﬁnd the measure of an angle of any regular polygon, we use the formula n − n 2 × 180, where n is the number of sides. Using 14 as the value for n, 14 1 − 4 2 × 180 = 1 1 2 4 × 180 or 154.3. If you chose a, you simply divided 360 (which is the sum of the exterior angles) by 14. If you chose b, you divided 180 by 14.

475. c. To ﬁnd how many cubic yards of sand are in the pile, we must ﬁnd the volume of the pile in cubic feet and convert the answer to cubic yards. The formula for volume of a cone is V = 1 3 (height)(Area of the base). The area of the base is found by using the formula Area = πr2. The area of the base of the sand pile is π(16)2 or 803.84 ft2. The height of the pile is 20 feet. The volume of the pile in cubic feet is (803.84)(20) or 5,358.93 ft3. To convert to cubic yards, divide 5,358.93 by 27 because 1 yard = 3 feet and 1 yd3 means 1 yd 1 yd 1 yd which equals 3 ft 3 ft 3 ft or 27 ft3. The answer is 198.5 yd3. If you chose a, you did not convert to cubic yards. If you chose b, you converted incorrectly by dividing 5,358.93 by 9 rather than 27. If you chose d, the area of the base formula was incorrect. Area of a circle does not equal πd2.

476. b.Observe that the octagon can be subdivided into 8 congruent triangles. Since each triangle has a base of 4 and a height of 7, the area of each traingle can be found using the formula, area = 1 2 base × height. To ﬁnd the area of the octagon, we will ﬁnd the area of a triangle and multiply it by 8. The area of one triangle is 1 2 (4)(7) or 14. Multiply this value times 8; (14)(8) = 112. This is the area of the octagon. If you chose a, you used an incorrect formula for area of a triangle. Area = base × height was used rather than area = 1 2 base × height. If you chose d, you mistakenly divided the octagon into 6 triangles instead of 8 triangles. 7 4 Another way to solve this problem is to use the formula for area of a regular polygon. That formula is area = 1 2 Pa, where P is the perimeter of the polygon and a is the apothem. If we know that the octagon is regular and each side is 4, that means the perimeter is 8 × 4 = 32. The apothem is the segment drawn from the center of the regular polygon and perpendicular to a side of the polygon; in this case it is 7. We substitute in our given values and get 1 2 (32)(7) = 112.

477. d.The sum of the measures of the angles of a quadrilateral is 360°. In the quadrilateral, three of the four angle measurements are known. They are 45° and two 90°angles. To ﬁnd ∠A, subtract these three angles from 360°, or 360 − 90 − 90 − 45 = 135°. This is the measure of angle A. If you chose a, you assumed ∠A and the 45° angle are complementary angles.

478. a. To ﬁnd the total area of the shaded region, we must ﬁnd the area of the rectangle minus the sum of the areas of all circles. The area of the rectangle is length × width. Since the rectangle is 4 circles long and 3 circles wide, and each circle has a diameter of 10 cm (radius of 5 cm 2), the rectangle is 40 cm long and 30 cm wide; (40)(30) = 1,200 cm2. The area of one circle is πr2 or π(5)2 = 25π. Multiply this value times 12, since we are ﬁnding the area of 12 circles, (12)(25)π = 300π. The difference is 1,200 − 300π cm2, the area of the shaded region. If you chose b, the area of the rectangle was incorrectly calculated as (20)(15). If you chose c, you reversed the area of the circles minus the area of the rectangle. If you chose d, you reversed choice b as the area of the circles minus the area of the rectangle.

479. c. Referring to the illustration, ∠NEB = 23° and ∠DES = 48°. Since ∠NEB + ∠BED + ∠DES = 180; using substitution, 23 + ∠BED + 48 = 180. Simplify; 72 + ∠BED = 180. Subtract 72 from both sides; ∠BED = 109°. If you chose a, you added 23 + 48 to total 71. If you chose b, you assumed ∠BED = ∠NEB. If you chose d, you assumed ∠BED = ∠DES.

480. a. The measure of an angle of a regular polygon of n sides is n – n 2 × 180. Since a hexagon has 6 sides, to ﬁnd the measure of ∠ABC, substitute n = 6 and simplify. The measure of ∠ABC is 6 − 6 2 × 180 or 120°. If you chose b, you assumed a hexagon has 8 sides. If you chose c, you assumed a hexagon has 5 sides. If you chose d, you assumed a hexagon has 10 sides.

481. d.The volume of a box is found by multiplying length × length × length or l × l × l = l3. If the length is doubled, the new volume is (2l) × (2l) × (2l) or 8(l3). When we compare the two expressions, we can see that the difference is a factor of 8. Therefore, the volume has been increased by a factor of 8.

482. a. The formula for ﬁnding the circumference of a circle is πd. If the radius is tripled, the diameter is also tripled. The new circumference is π3d. Compare this expression to the original formula; with a factor of 3, the circumference is multiplied by 3.

483. a. The formula for the surface area of a sphere is 4πr2. If the diameter is doubled, this implies that the radius is also doubled. The formula then becomes 4π(2r)2. Simplifying this expression, 4π(4r2) equals 16πr2. Compare 4πr2 to 16πr2; 16πr2 is 4 times greater than 4πr2. Therefore, the surface area is four times as great. 48°

484. b.If the diameter of a sphere is doubled, the radius is also doubled. The formula for the volume of a sphere is 4 3 πr3. If the radius is doubled, volume = 4 3 π(2r)3 which equals 4 3 π(8r3) or 4 3 (8)πr3. Compare this equation for volume with the original formula; with a factor of 8, the volume is now 8 times as great.

485. b.The formula for the volume of a cone is 1 3 πr2h. If the radius is doubled, then volume = 1 3 π(2r)2h or 1 3 π4r2h. Compare this expression to the original formula; with a factor of 4, the volume is multiplied by 4.

486. a. The formula for the volume of a cone is 1 3 πr2h. If the radius is halved, the new formula is 1 3 π(1 2 r)2h or 1 3 π(1 4 )r2h. Compare this expression to the original formula; with a factor of 1 4 , the volume is multiplied by 1 4 .

487. b.The volume of a right cylinder is πr2h. If the radius is doubled and the height halved, the new volume is π(2r)2(1 2 h) or π4r2(1 2 h) or 2πr2h. Compare this expression to the original formula; with a factor of 2, the volume is multiplied by 2.

488. a. The formula for ﬁnding the volume of a right cylinder is volume = πr2h. If the radius is doubled and the height is tripled, the formula has changed to π(2r)2(3h). Simpliﬁed, π4r23h or π12r2h. Compare this expression to the original formula; with a factor or 12, the volume is now multiplied by 12.

489. c. The measure of an angle of a regular polygon of n sides is n − n 2 × 180. Since each angle measures 144°, we will solve for n, the number of sides. Using the formula 144 = n − n 2 × 180, solve for n. Multiply both sides by n, 144n = (n − 2)180. Distribute by 180, 144n = 180n − 360. Subtract 180n from both sides, −36n = −360. Divide both sides by −36, n = 10. The polygon has 10 sides.

490. d.This problem requires two steps. First, ﬁnd the diagonal of the base of the box. Second, using this value, ﬁnd the length of the diagonal AB . To ﬁnd the diagonal of the base, use 30 cm as a leg of a right triangle, 8 cm as the second leg, and solve for the hypotenuse. Using the Pythagorean theorem, 302 + 82 = c2; 900 + 64 = c2; 964 = c2; c = 31.05. Now consider this newly obtained value as a leg of a right triangle, 12 cm as the second leg, and solve for the hypotenuse, AB ; 31.052 + 122 = AB 2; 964 + 144 = AB 2; 1,108 = AB 2. AB = 33.3. If you chose a, you used 30 and 12 as the measurements of the legs. If you chose b, you solved the ﬁrst triangle correctly; however, you used 8 as the measure of one leg of the second triangle, which is incorrect.

491. c. To ﬁnd the area of the shaded region, we must ﬁnd 1 2 the area of the circle with diameter AC, minus 1 2 the area of the circle with diameter BC, plus 1 2 the area of the circle with diameter AB. To ﬁnd 1 2 the area of the circle with diameter AC, we use the formula area = 1 2 πr2. Since the diameter is 6, the radius is 3; therefore, the area is 1 2 π32 or 4.5π. To ﬁnd 1 2 the area of the circle with diameter BC, we again use the formula area = 1 2 πr2. Since the diameter is 4, the radius is 2; therefore the area is 1 2 π22 or 2π. To ﬁnd 1 2 the area of the circle with diameter AB we use the formula area = 1 2 πr2. Since the diameter is 2, the radius is 1; therefore the area is 1 2 π. Finally, 4.5π−2π + .5π = 3π, the area of the shaded region. If you chose a or b, in the calculations you mistakenly used πd2 as the area formula rather than πr2.

492. a. This problem has three parts. First, we must ﬁnd the diameter of the existing tower. Secondly, we will increase the diameter by 16 meters for the purpose of the fence. Finally, we will ﬁnd the circumference using this new diameter. This will be the length of the fence. The formula for circumference of a circle is πd. This formula, along with the fact that the tower has a circumference of 40 meters, gives us the following formula: 40 = πd. To solve for d, the diameter, divide both sides by π. D = 4 π 0 the diameter of the existing tower. Now increase the diameter by 16 meters; 4 π 0 + 16 to get the diameter of the fenced in section. Finally, use this value for d in the equation πd or π( 4 π 0 + 16) meters. Simplify by distributing π through the expression; (40 + 16π) meters. This is the length of the security fence. If you chose b, you added 8 to the circumference of the tower rather than 16. If you chose c, you merely added 8 to the circumference of the tower.

493. a. Using the illustration, ∠2 = ∠a.∠2 and ∠aare vertical angles. ∠1 and ∠aare supplementary, since ∠c+ ∠d+ ∠1 + ∠a= 360˚ (the total number of degrees in a quadrilateral), 90 + 90 + ∠1 + ∠a= 360. Simplifying, 180 + ∠1 + ∠a= 360. Subtract 180 from both sides; ∠1 + ∠a= 180. Since ∠a = ∠2, using substitution, ∠1 + ∠2 = 180. Using similar logic, ∠4 = ∠b. ∠4 and ∠bare vertical angles. ∠3 and ∠bare supplementary. ∠e+ ∠f+ ∠b + ∠3 = 360 or 90 + 90 + ∠b+ ∠3 = 360. Simplifying, 180 + ∠b+ ∠3 = 360. Subtract 180 from both sides, ∠b + ∠3 = 180. Since ∠b = ∠4, using substitution, ∠3 + ∠4 = 180. Finally, adding ∠1 + ∠2 = 180 to ∠3 + ∠4 = 180, we can conclude ∠1 + ∠2 + ∠3 + ∠4 = 360.

494. a. To ﬁnd the volume of the hollowed solid, we must ﬁnd the volume of the original cone minus the volume of the smaller cone sliced from the original cone minus the volume of the cylindrical hole. The volume of the original cone is found by using the formula V = 1 3 πr2h. Using the values r = 9 and h = 40, substitute and simplify to ﬁnd the volume = 1 3 π(9)2(40) or 1,080π cm3. The volume of the smaller cone is found by using the formula V = 1 3 πr2h. Using the values r = 3 and h = 19, substitute and simplify to ﬁnd the volume = 1 3 π(3)2(19) or 57π cm3. The volume of the cylinder is found by using the formula V = πr2h. Using the values r = 3 and h = 21, substitute and simplify to ﬁnd the volume = π(3)2(21) or 189π cm3. Finally, calculate the volume of the hollow solid; 1,080π−57π−189π or 834π cm3. If you chose b, you used an incorrect formula for the volume of a cone, V = πr2h. If you chose c, you subtracted the volume of the large cone minus the volume of the cylinder. If you chose d, you added the volumes of all three sections.

495. c. To ﬁnd the volume of the object, we must ﬁnd the volume of the water that is displaced after the object is inserted. Since the container is 5 cm wide and 15 cm long, and the water rises 2.3 cm after the object is inserted, the volume of the displaced water can be found by multiplying length by width by depth: (5)(15)(2.3) 172.5 cm3.

496. a. To ﬁnd how many cubic yards of concrete are needed to construct the wall, we must determine the volume of the wall. The volume of the wall is calculated by ﬁnding the surface area of the end and multiplying it by the length of the wall, 120 ft. The surface area of the wall is found by dividing it into three regions, calculating each region’s area, and adding them together. The regions are labeled A, B, and C. To ﬁnd the area of region A, multiply the length (3) times the height (10) for an area of 30 ft2. To ﬁnd the area of region B, multiply the length (5) times the height (3) for an area of 15 ft2. To ﬁnd the area of region C, multiply 1 2 times the base (2) times the height (4) for an area of 4 ft2. The surface area of the end is 30 ft2 + 15 ft2 + 4 ft2 or 49 ft2. Multiply 49 ft2 by the length of the wall 120 ft; 5,880 ft3 is the volume of the wall. The question, however, asks for the answer in cubic yards. To convert cubic feet to cubic yards, divide 5,880 ft3 by 27 ft3, the number of cubic feet in one cubic yard, which equals 217.8 yd3. If you chose b, you did not convert to yd3. If you chose c, the conversion to cubic yards was incorrect. You divided 5,880 by 9 rather than 27. If you chose d, you found the area of the end of the wall and not the volume of the wall.

497. b.To ﬁnd the volume of the sphere we must ﬁnd the volume of the outer sphere minus the volume of the inner sphere. The formula for volume of a sphere is 4 3 πr3. The volume of the outer sphere is 4 3 π(120)3. Here the radius is 10 feet (half the diameter) multiplied by 12 (converted to inches), or 120 inches. The volume equals 7,234,560 in3. The volume of the inner sphere is 4 3 π(119)3 or 7,055,199. (This is rounded to the nearest integer value.) The difference of the volumes is 7,234,560 − 7,055,199 or 179,361 in3. This answer is in cubic inches, and the question is asking for cubic feet. Since one cubic foot equals 1,728 cubic inches, we simply divide 179,361 by 1,728, which equals 104, rounded to the nearest integer value. As an alternative to changing units to inches only to have to change them back into feet again, keep units in feet. The radius of the outer sphere is 10 feet and the radius of the inner sphere is one inch less than 10 feet, which is 9 and 1 1 1 2 feet, or 9.917 feet. Use the formula for volume of a sphere: 4π 3 r3 and ﬁnd the difference in the volumes. If you chose a, you used an incorrect formula for the volume of a sphere, V = πr3. If you chose c, you also used an incorrect formula for the volume of a sphere, V = 1 3 πr3. If you chose d, you found the correct answer in cubic inches; however, your conversion to cubic feet was incorrect.

498. c. To solve this problem, we must ﬁnd the volume of the sharpened tip and add this to the volume of the remaining lead that has a cylindrical shape. To ﬁnd the volume of the sharpened point, we will use the formula for ﬁnding the volume of a cone, 1 3 πr2h. Using the values r = .0625 (half the diameter) and h = .25, the volume = 1 3 π(.0625)2(.25) or .002 in3. To ﬁnd the volume of the remaining lead, we will use the formula for ﬁnding the volume of a cylinder, πr2h. Using the values r = .0625 and h = 5, the volume = π(.0625)2(5) or .0613. The sum is .001 + .0613 or .0623 in3, the volume of the lead. If you chose a, this is the volume of the lead without the sharpened tip. If you chose b, you subtracted the volumes calculated.

499. b.To ﬁnd the volume of the hollowed solid, we must ﬁnd the volume of the cube minus the volume of the cylinder. The volume of the cube is found by multiplying length × width × height or (5)(5)(5) equals 125 in3. The value of the cylinder is found by using the formula πr2h. In this question, the radius of the cylinder is 2 and the height is 5. Therefore, the volume is π(2)2(5) or 20π. The volume of the hollowed solid is 125 − 20π. If you chose a, you made an error in the formula of a cylinder, using πd2h rather than πr2h. If you chose c, this was choice a reversed. This is the volume of the cylinder minus the volume of the cube. If you chose d, you found the reverse of choice b.

500. b.Refer to the diagram to ﬁnd the area of the shaded region. One method is to enclose the ﬁgure into a rectangle, and subtract the area of the unwanted regions from the area of the rectangle. The unwanted regions have been labeled A through F. The area of region A is (15)(4) = 60. The area of region B is (5)(10) = 50. The area of region C is (20)(5) = 100. The area of region D is (17)(3) = 51. The area of region E is (20)(5) = 100. The area of region F is (10)(5) = 50. The area of the rectangle is (23)(43) = 989. The area of the shaded region is 989 − 60 − 50 − 100 − 51 − 100 − 50 = 578. If you chose a, c or d, you omitted one or more of the regions A through F.

501. d.The shape formed by the paths of the two arrows and the radius of the bull’s eye is a right triangle. The radius of the bull’s eye is one leg and the distance the second arrow traveled is the second leg. The distance the ﬁrst arrow traveled is the hypotenuse. To ﬁnd the distance the ﬁrst arrow traveled, use the Pythagorean theorem where 2 meters (half the diameter of the target) and 20 meters are the lengths of the legs and the length of the hypotenuse is missing. Therefore, a2 + b2 = c2 and a = 2 and b = 20, so 22 + 202 = c2. Simplify: 4 + 400 = c2. Simplify: 404 = c2. Find the square root of both sides: 20.1 = c. So the ﬁrst arrow traveled about 20.1 meters. If you chose c, you added the two lengths together without squaring. If you chose b, you added Kim’s distance from the target to the diameter of the target. If you chose a, you let 20 meters be the hypotenuse of the right triangle instead of a leg and you used the radius of the target.