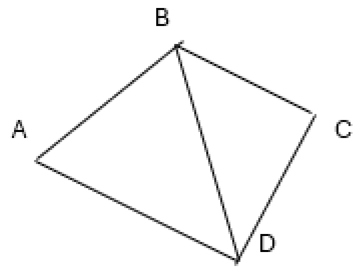
Question	Answer	Solution
1	24	A radius from the center of the circle perpendicular to the chord bisects the chord. Connecting the center to the end of the chord forms a right triangle with one leg equal to 7 cm (half the chord) and a hypotenuse equal to the radius, 25 cm. Using the Pythagorean Theorem, the missing leg is 24 cm which is the distance from the center to the chord.
2	$28\sqrt{2}$	The circle has radius of 7. If two diagonals of the square are drawn, four right triangles whose legs are radii are formed. These are 45-45-90 triangles, so the hypotenuse is $7\sqrt{2}$ and the perimeter of the square is 4(side) which is $28\sqrt{2}$.
3	148	This forms isosceles ΔABD with $\angle B \cong \angle D$. Since there are 180° in a triangle, m$\angle A$ = 74°. $\angle A$ measures ½ the intercepted arc so minor arc BD measures 148.
4	$2\sqrt{91}$	Use the Law of Cosines to find the measure of s. $s^2 = 10^2 + 12^2 - 2(10)(12)(\cos 120) = 100 + 144 - 240(-1/2) = 364$ $s = \sqrt{364} = 2\sqrt{91}$
5	$\frac{\pi - 2}{\pi}$ or $1 - \frac{2}{\pi}$	We need the ratio of the area inside the circle but outside the square to the area of the circle for the probability. Let r be the radius of the circle. Then 2r is the diagonal of the square. The square has area = ½(2r)(2r) = $2r^2$ and the circle has area = πr^2. Area inside circle and outside square = $\pi r^2 - 2r^2$ and we divide by πr^2 and reduce, dividing out the r^2.
6	156	There are 15 congruent exterior angles of the polygon and their sum is 360, so 360/15 gives exterior angles of 24. The interior angle is supplementary to the exterior angle so it is 180 – 24 or 156.
7	$\frac{15}{4}$ or 3.75	Adjacent sides of a rectangle are perpendicular so their slopes have a product of -1. The two slopes are -3/4 and 5/k. Thus -15/4k = -1 and k = 15/4.
8	4	The two lines are parallel and the second line has a y-intercept of (0, 1). We need to determine the distance from that point to the first line. Putting the first line into $Ax + By + C = 0$ form, we get $3x - 4y - 16 = 0$. Distance from point to line = $\frac{\lvert Ax_1+By_1+C\rvert}{\sqrt{A^2+B^2}}$ = $\frac{\lvert 3(0)+(-4)(1)+(-16)\rvert}{\sqrt{3^2+(-4)^2}}$ = $\frac{20}{5}$ = 4
9	$5\sqrt{2}$	Traveling east-west, Ahbi goes 5 west and 10 east, ending up 5 miles east of the hotel. Traveling north-south, Ahbi goes 8 north and 3 south, ending up 5 miles north of the hotel. So Ahbi is 5 miles north and 5 miles east of his starting point which makes an isosceles right triangle. The hypotenuse is $5\sqrt{2}$ which is his straight-line distance from the hotel.
10	$32\pi\sqrt{3}$	The space diagonal of the cube is the diameter of the sphere. The cube has a space diagonal of $side\sqrt{3}$ which is $4\sqrt{3}$. This makes the radius of the sphere $2\sqrt{3}$. The sphere's volume is $(4/3)\,\pi\,(2\sqrt{3})^3 = (4\pi/3)(24\sqrt{3}) = 32\pi\sqrt{3}$.

11	$\overline{AD}$	 In $\Delta ABD,\ m\angle ABD = 65°$ In $\Delta CBD\ ,\ m\angle CBD = 52°$ The longest side is opposite the largest angle in a triangle, so the longest side of ΔCBD is $\overline{BD}$ and the longest side of ΔABD is $\overline{AD}$. Since both segments are in the same triangle, the longest side is $\overline{AD}$.
12	32	A dodecahedron has 12 faces. A cube has 8 vertices. A hexagonal pyramid has 12 edges. 12 + 12 + 8 = 32
13	37.72 or 37 18/25 or 943/25	7-24-25 is a Pythagorean triple so the triangle is a right triangle and two of the altitudes are the legs, 7 and 24. The altitude to the hypotenuse may be found by using similar triangle ratios. Let h be the altitude to the hypotenuse. The two small right triangles are both similar to the large right triangle. Thus, $\frac{7}{h} = \frac{25}{24}$ and $h = \frac{7(24)}{25} = 6.72$ The sum of the altitudes is 7 + 24 + 6.72 = 37.72 or 37 18/25.
14	18	$A = \left(\pm\frac{1}{2}\right)\begin{vmatrix} -2 & 5 & 1 \\ 3 & 1 & 1 \\ -1 & -3 & 1 \end{vmatrix} = \left(\pm\frac{1}{2}\right)(-2-5-9+1-6-15) = \left(-\frac{1}{2}\right)(-36)$ $= 18$
15	$5\sqrt{17}$	Draw in radii AX and BY. Draw a segment from B that is parallel to XY and intersects AX at point C. Consider ΔABC which is a right triangle with BC = 20 and AC = 5. Apply the Pythagorean Theorem to find AB. $AB^2 = 25 + 400 = 425$ So AB = $\sqrt{425} = 5\sqrt{17}$
16	90π	The base of the original cone has a radius of 10. The small cone that was cut off is similar to the original cone. The radii have a 6:10 or 3:5 ratio so the heights must also have that same ratio. Let h be the height of the small cone. $\frac{3}{5} = \frac{h}{h+5}$ which leads to h = 15/2 or 7.5. For the smaller cone, $V = \frac{1}{3}\pi r^2 h = \frac{\pi}{3}(6)^2(7.5)$ = 90π
17	$3\sqrt{5}$ - 3	The shortest distance will be a part of the segment joining the centers of the circles and containing points A and B. The circle with point A has a radius of $2\sqrt{5}$ and the circle with point B has a radius of 3. The segment joining the centers, (2, -5) and (7, 5), has a length of $d = \sqrt{(7-2)^2 + (5+5)^2} = \sqrt{25+100} = \sqrt{125} = 5\sqrt{5}$. Subtract the two radii from this segment for the shortest distance between A and B. $5\sqrt{5} - 3 - 2\sqrt{5} = 3\sqrt{5} - 3$

18	800	A radius increased by 200% is 3 times as long as the original radius. The ratio of linear distances is 1:3 so the areas have that ratio squared 1:9. That is an 800% increase.
19	80	$\angle Z$ is inscribed in the circle so its intercepted arc $\widehat{WY}$ measures 100°. $\angle X$ is an angle formed by tangents and is ½ $\left(\widehat{WZY} - \widehat{WY}\right) = \frac{1}{2}(260 - 100) = 80$
20	(5/2, -1/2)	Plotting the 3 points and forming a triangle, you can check the slopes of two sides that appear perpendicular and find that they are -3/5 and 5/3 which makes the legs perpendicular. The center of a circumscribed circle will then be the midpoint of the hypotenuse of the right triangle which is (5/2, -1/2)
21	33	Rectangle area is length times width so $x(2x-3) = 65$ $2x^2 - 3x - 65 = 0$ which factors into $(2x-13)(x+5) = 0$ with solutions of 13/2 and -5. Only the positive root works as a length, so x = 13/2. The perimeter of the rectangle = 2(L + W) = 2(x + 2x – 3) = 2(3x – 3) = 6x – 6 Substituting for x gives 6(13/2) – 6 = 39 – 6 = 33
22	224	Area of a rhombus is half the product of its diagonals. ½(16)(28) = 224
23	- 4	The altitude must be perpendicular to $\overline{BC}$ and contain point A. The slope of $\overline{BC}$ is $\frac{10-0}{0-8} = -\frac{5}{4}$ so the altitude must have a slope of $\frac{4}{5}$ and contain (-4, 0). $y = mx + b$ gives $0 = \frac{4}{5}(-4) + b$ so $b = \frac{16}{5}$ $y = \frac{4}{5}x + \frac{16}{5} \implies 5y = 4x + 16 \Rightarrow 4x - 5y = -16$ RS - T = 4(-5) – (-16) = - 4
24	2	If two chords intersect inside a circle, the product of their parts must be equal. AE (EC) = BE(DE) ⇒ (a + 4)(a + 2) = (a + 1)(a + 6) $a^2 + 6a + 8 = a^2 + 7a + 6$ $2 = a$
25	$14\frac{2}{9}$ or 128/9	The areas of the 3 rings are: center = 4π, middle ring = 16π - 4π = 12π, and outer ring = 36π - 16π = 20π The probability of hitting each ring is: center = $\frac{4\pi}{36\pi} = \frac{1}{9}$, middle ring = $\frac{12\pi}{36\pi} = \frac{1}{3}$, and outer ring = $\frac{20\pi}{36\pi} = \frac{5}{9}$ Expected value of a dart is the sum of the probability times the value of each ring. $EV = \frac{1}{9}(20) + \frac{1}{3}(16) + \frac{5}{9}(12) = \frac{20}{9} + \frac{16}{3} + \frac{60}{9} = \frac{128}{9} = 14\ \frac{2}{9}$