1. E
2. B
3. D
4. A
5. D
6. C
7. B
8. B
9. C
10. B
11. C
12. E
13. C
14. A
15. D
16. B
17. C
18. A
19. A
20. A
21. D
22. D
23. C
24. B
25. C
26. C
27. D
28. B
29. B
30. E

1.   E   Both lights will be lit at the least common multiple of the two durations, which is 2 * 3 * 17 = 102. Though remember that 102 seconds will be at the end of the next full cycle, and both lights are on for 1 second before then, so the actual amount of time is 101 seconds.

2.   B   Since the velociraptor will always move 10 metres per second faster than you, you can view this problem as you standing still and the velociraptor approaching you at 10 metres per second. Since the gap betwixt us is 100 metres, it will take 10 seconds to reach you.

3.   D   Draw a picture! Your area looks like ¾ of a circle with radius 60, and ¼ of a circle with radius 10 from going around the corner of the barn. Thus, the area will be $(\frac{3}{4})\pi(60^2) + (\frac{1}{4})\pi(10^2) = 2725\pi$.

4.   A   The volume for which your shouts will be audible is ¼ of a sphere, since your shouts are blocked from behind by the wall and below by the ground. Thus, the volume will be $(\frac{1}{4})\frac{4}{3}\pi(\frac{1}{2})^3 = \frac{\pi}{24}$.

5.   D   Draw a picture! The circle will be tangent to the triangle at the midpoints of the sides, and drawing 3 lines from the centre of the circle to the vertices of the triangle creates 6 30-60-90 triangles, from which you can find that the radius of the circle is $\frac{S}{2\sqrt{3}}$, so the area of the circle is $\frac{\pi S^2}{12}$.

6.   C   Chicken McNugget Theorem tells us that the answer is 5 * 7 – 5 – 7, which is 23. Alternatively, simply list out numbers until you notice that every number above 23 is obtainable.

7.   B   Pythagorean theorem – draw a picture and use $a^2 + b^2 = c^2$ to get the answer of $2\sqrt{26}$.

8.   B   Draw a picture! The picture is a 30-60-90 triangle, so the angle is 30 degrees.

9.   C   Draw a 2-way table to find the probabilities. Conditional probability tells us that the answer is $\frac{\frac{1}{2}}{\frac{1}{2}+(\frac{1}{2}*\frac{3}{10})} = \frac{10}{13}$.

10.   B   Draw a CAT (concentration, amount, total) table and use it to set up the equation $x + .15 = (.02)x + .3; x = 15/98$.

11.   C   The question asks for the ratio of intensities, so solve for I in the original equation. I_0 is a constant, and will cancel out in the division. Plug in the given D values to obtain a ratio of $\frac{10^{11}}{10^9}$, which is 100.

12.   E   In effect, half a litre is being drained from the pool every second. Starting with 200 litres of solution, it will take 400 seconds to fully drain the pool.

13.   C   The graph takes on the shape of a square with side length $4\sqrt{2}$, which has an area of 32. Filling it with 64 cubic units of concrete will yield a depth of 2 units.

14.   A   Set up the equation $P = 23(\frac{1}{2})^t$, where P is the population after time t. Since we want P to be a one-digit number, and fast, P will be 9. Solving for t, it will be $\log_{\frac{1}{2}}\frac{9}{23}$, which can be simplified to A by raising the base and argument of the log to the (-1) power.

15. D Draw a picture! The circles will actually be tangent $(2 + 6 = 8)$, simplifying the problem somewhat. The band effectively look like two straight tangent lines tangent to the circles, and some fraction of the circumferences of the circles. To find its length, draw the line connecting the centres of the circles and the radii perpendicular to the tangents. Then, draw 2 line segments from the centre of the smaller circle perpendicular to the radii of the larger circle, creating a rectangle and a triangle on either side of the centre line. Since the short side of the rectangle is the radius of the smaller circle, its length is 2. The length on the other side will also be 2, meaning that the short side of the triangle will be 4. Since the hypotenuse of the triangle is 8, the triangles are 30-60-90 triangles and the tangent to the circles will have length $4\sqrt{3}$. Using the angles from the 30-60-90, 2/3 of the larger circle will be banded, while only 1/3 of the smaller circle is banded. Summing the lengths, the answer will be $\frac{28\pi}{3} + 8\sqrt{3}$.

16. B If my average in the class is an 87 so far, you can assume that I have received an 87 on all three tests. Thus, you can produce an equation $\frac{261 + x \ (the \ final \ test \ score)}{4} = 90$, yielding x must be, at minimum, 99.

17. C The probability that the first card is a Joker is 2/54, and the probability that the second card is a Joker is 1/53, since one of the Jokers has been removed. Multiplying these, you get the answer of 1/1431.

18. A Using the number of days in each month, you can calculate that there are 209 days between the two dates. Since every 7 days returns you to Wednesday, 209 days, which is 1 less than a multiple of 7, will result in Tuesday.

19. A Rewriting the parabola, the equation becomes (y-2) = -(x-3)^2. The length of the latus rectum is the coefficient in front of the x-polynomial term, which in this case is 1. The distance from the vertex to the focus is 1/4th of that, which is .25. Since the width of the drone is also 1, then the distance from the focus to the vertex will be the maximum height of the drone, which is ¼.

20. A The cats can sit 1 seat apart or 2 seats apart, since if they sat 3 seats apart they would be sitting 2 seats apart in the other direction. Humans will fill the gaps left by the cats and are indistinguishable, so they don't matter. The cats, which are distinguishable, can also swap seats, yielding 2 possibilities for seats between them * 2 ways to fill the seats = 4 arrangements.

21. D This is not a principle of inclusion-exclusion question! If you read the question carefully, it is specified that the seniors take 1, 2, 3, or 4 classes specifically, meaning that you can simply sum the four numbers together for your answer (4 + 17 + 24 + 35 = 80). Sorry, but I did say it was a reading comprehension exam!

22. D After one year, Frank will have (1.02)(568) pounds, or £579.36. In another year, he will have (1.02)(579.36), or £590.9472, which rounds to £590.95.

23. C The equation is $x^3 = 12649337$. Looking at the units digit, x must have units digit of 3. Also, using the fact that $230^3 = 12167000$, we can see that the answer is a bit greater than 230. Combined with the fact that the answer is an integer, it must be 233.

24. B The sum of squared integers from 1 to n is (n)(n+1)(2n+1)/6 = 1240. Alternatively, list out the 15 numbers and add them together.

25. C   The height and base of the arch are both 4, so using the formula $\frac{2}{3}bh$ (the area of a parabolic arch, where b is the length of the base and h is the height) gives 32/3.

26. C   Exploiting symmetry, notice that flipping 3, 4 or 5 heads is the same as flipping 0, 1, or 2 heads, since each coin flip is either heads or tails with equal probability. Probabilities must sum to 1, so the probability of 3/4/5 heads and the probability of 0/1/2 heads are both ½.

27. D   Draw a picture! Notice that these are two infinite geometric series, one for the ball bouncing upwards, and one for the ball rebounding. Compute $\frac{a}{1-r}$ (the formula for the sum of an infinite geometric series) for both series and add them to get 20.

28. B   Suppose the game does not end on a 6, but continues for 6 rounds instead. Then there is one number at the end of each round, ranging from 1 to 6. When put together, it's a random permutation of 123456.

         Eric gets the numbers in positions 1, 3, 5, and Erick gets the numbers in positions 2, 4, 6. 6 is equally likely to be in any of the positions, so each player has a ½ chance to win the game.

29. B   The shape of a rectangular pen with maximized area with one side given to you is a rectangle of sides x, x, and $2x$, where $2x$ is the side length provided by the barn (feel free to try some other shapes). Thus, the side lengths will be 5 and 10, for an area of 50.

30. E x certainly can be 2, but don't forget that x can be negative 2 as well! Since the solution set is not complete, the answer is E.