1) In a group of five friends:
  - Amy is taller than Carla.
  - Dan shorter than Eric but taller than Bob.
  - Eric is shorter than Carla.

Who is the shortest?

2) The segment with endpoints P(-4, 0) and Q(16, 0) is the diameter of a semi-circle. If the point R(0, t) is on the circle with t > 0, then find the value of t.

3) Find the smallest two-digit positive integer k for which the product $45k$ is a perfect square.

4) In a group of 20 friends, 11 like to ski, 13 like to snowboard, and 3 do not do either. How many of the friends like to both ski and snowboard?

5) Evaluate the product $\log_3 16 \cdot \log_2 27$.

6) Suppose a = 212 and b = 2201 are numbers expressed in the base 3 number system. Find the value of the product ab in base 3.

7) There is only one common prime divisor of 251873, 234631, and 209467. What is it?

8) In rectangle ABCD side AB is one third longer than side BC. Point E divides BC such that EC is twice as long as BE. Point F is chosen on AE to make AE perpendicular to DF. Find the ratio of the area of triangle ADF to the area of rectangle ABCD.
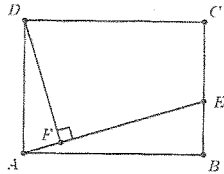

9) Build-For-Replacement, or BFR, makes laptop computers for home users. A study finds that the probability of a randomly selected BFR computer needing repair or replacement within the first 2 months is 20%. Dr. Geek of the Technology Institute bought 3 BFR computers yesterday. What is the probability that at least one of his computers will need repair or replacement within the 2 months?

10) Evaluate $\dfrac{\cot^2 \theta - \tan^2 \theta}{2 + \cot^2 \theta + \tan^2 \theta}$ when θ equals 15 degrees.

11) There is only one prime number p which can be written as $a^4 + b^4 + c^4 - 3$ with a, b, and c all prime, not necessarily distinct. What is the value of p.

12) A square is cut along a diagonal and reassembled to form the parallelogram as shown in the diagram. If PR is 90, what is the area of the original square?
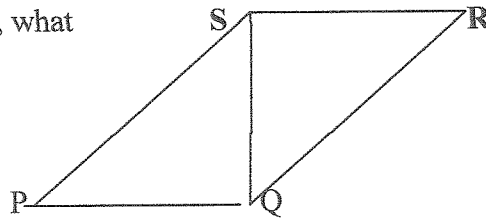
Answers		
1)	2)	3)
4)	5)	6)
7)	8)	9)
10)	11)	12)

13) In what base $b > 1$ does the equation $\left(24_b\right)^2 = 642_b$ hold? (Both numbers are written in base b)

14) Determine the product of the roots of the equation $|x|\left(|x| - 5\right) = -6$.

15) Jaz can answer each question on a test in 4 minutes and George can answer each question in 1 minute. George takes a nap for one hour in the middle of the test. They both start and finish at the same time. How many questions were on the test?

16) A straight pole which was vertical is broken into two pieces 36 feet from the ground. The top part comes down directly from the break until it touches the ground 27 feet from the bottom of the pole. How many feet tall was the pole?

17) There are two circles which pass through the points (1, 9) and (8, 8) and are tangent to the x-axis. What are the radii?

18) What is the distance between the points of intersection of the curves $y = x^2 + x$ and $y = 3x + 4$?

19) The equation $x^3 - 3x^2 + bx + 6 = 0$ has three distinct real solutions which form an arithmetic progression. What is the ordered pair $\left(b, r\right)$, where r is the smallest solution of the equation?

20) A piece of paper in the shape of an equilateral triangle ABC has AB = 12. When A is folded over to point D on BC for which BD = 3, a crease is formed along a line that joins a point on AB to a point on AC. What is the length of this crease?

21) Given that $1 - r + r^2 - r^3 + \cdots = s$ and $1 + r^2 + r^4 + r^6 + \cdots = 4s$, compute s.

22) The average of six distinct real numbers is 275. The average of the four least numbers is 200. The average of the four greatest is 340. Compute the average of the middle two numbers.

23) Let f be a function such that for all x, $f(x) = f(x+1) + f(x-1)$. Given that $f(20) = 15$ and f(15)=20, compute $f(20152015)$.

24) Let x be a real number in the interval $[0, 360]$ such that the four expressions $\sin x^o, \cos x^o, \tan x^o, \cot x^o$ take on exactly three distinct (finite) real values. Compute the sum of all possible values of x.

ANSWERS

13)	14)	15)
16)	17)	18)
19)	20)	21)
22)	23)	24)