

Answer as many questions as you can. They do not all carry equal marks. Show all working and explain what you are doing.

1. Fred throws an ordinary die, then Rod throws the same die. What is the probability that Fred throws a higher number than Rod?
2. A reservoir is in the form of a perfect circle. A perch (pole, rod) starts at the edge and swims 600 m due north before meeting the edge again. He then turns due east and swims a further 800 m before running aground. What is the diameter of the reservoir?
3. What conclusion can you draw from the following propositions?
 - (a) No kitten that loves fish is unteachable.
 - (b) No kitten without a tail will play with a gorilla.
 - (c) Kittens with whiskers always love fish.
 - (d) No teachable kitten has green eyes.
 - (e) No kittens have tails unless they have whiskers.

(with grateful thanks to FMH)

4. Solve:

$$\begin{aligned}x + 7y + 3v + 5u &= 16 \\8x + 4y + 6v + 2u &= -16 \\2x + 6y + 4v + 8u &= 16 \\5x + 3y + 7v + u &= -16\end{aligned}$$

5. In a tetrahedron, which is not necessarily regular, two opposite edges have the same length, a , and they are perpendicular to each other. Moreover they are each perpendicular to a line of length, b , which joins their midpoints. Express the volume of the tetrahedron in terms of a and b .
6. I have ten pockets and 44 one penny coins which I wish to distribute so that each pocket contains a different number of pence. Show how this may be done or prove it to be impossible.
7. Noreen beat Shelagh in a set of tennis, winning six games to Shelagh's three. Five games were won by the non-serving player. Who served first?
8. A square barn of side 42 feet stands in the middle of a large field. A goat is tethered to the midpoint of one side by a rope 105 feet long. What area of the field can the goat graze? (~~Take $\pi = 22/7$~~)
9. A bicycle is held upright so that it will not topple over, but is perfectly free to move backwards and forwards. When the pedal cranks are in the vertical position a backward force is applied to the lower pedal. Which way, if at all, does the bicycle move? Explain.
Are you sure.....?
10. Three Navaho women sit side by side on the ground. The first woman, who is sitting on a goatskin, has a son who weighs 140 lbs. The second woman, who is sitting on a deerskin, has a son who weighs 160 lbs. The third woman weighs 300 lbs and is sitting on a hippopotamus skin (presumably imported). What famous theorem does this symbolise? Marks will be awarded for exhibiting that you still have your sense of humour after doing this paper!

Are you quite sure about Number 9.....?