

Numbers test

Maths 5
Non-calculator section.

Name: _____

1. Change the notation of these numbers

a) 6300 decimal to binary. (1 0 0)

b) 1280 decimal to octagesimal.(1 0 0)

c) FABA hexadecimal to decimal.(1 0 0)

d) 1011011 binary to decimal.(1 0 0)

e) 10111 decimal to binary.(1 0 0)

2. Calculate

a) $1450 \pmod{3}$ (1 0 0)

b) $3801 \pmod{51} (1\ 0\ 0)$

c) $16321 \pmod{20} (1\ 0\ 0)$

d) $2^{151} \pmod{7} (1\ 0\ 0)$

3. Find the last figure of

a) $3^{2417} (1\ 0\ 0)$

b) $9^{50} + 5^{50} (1\ 1\ 0)$

c) $6^{235557845249} (0\ 0\ 1)$

4. For a given number p it is true that $p^2 + 5p + 1$ is even.

a) Prove that, if this is true for p , then it is also true for the following number. (0 2 0)

b) Prove that there is no such number p . (0 1 1)

5. Write in the form of a sum

a) $1 \cdot 4 + 2 \cdot 5 + 3 \cdot 6 + 4 \cdot 7 + \dots$ (1 0 0)

b) $\frac{1}{1} + \frac{1}{1} + \frac{1}{2 \cdot 1} + \frac{1}{3 \cdot 2 \cdot 1} + \frac{1}{4 \cdot 3 \cdot 2 \cdot 1} + \dots$ (0 2 0)

c) $2 + 4 + 10 + 28 + 82 + \dots$ (0 1 1)

6. Prove, using induction, that

a) (1 1 0)

$$\sum_{k=1}^n k(k+1) = \frac{n(n+1)(n+2)}{3}$$

b) (1 2 0)

$$\sum_{k=1}^n \frac{1}{k(k+1)} = \frac{n}{n+1}$$

c) $7^n - 2^n$ is divisible by 5 for all positive integers. (1 1 0)

d) $2^n < n!$ for all integers larger than 3 (1 1 1)

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Calculator section.

1. A gardener is very fond of mint and plants 0.1 m^2 of mint every year in a different location. The mint spreads at a rate of 30% per year.

a) Write an expression, using a sum, that represents the total surface covered by mint depending on the number of times he has planted. (1 1 0)

b) Calculate the surface covered by the mint after having planted 45 times. (1 1 0)

2. A birth control pill contains 2 mg of an active ingredient, and once inside the body, it degrades at a rate of 30% per day.

a) Calculate the maximum amount of the active ingredient that can be reached if one pill is ingested per day. (1 1 0)

There is risk of the treatment being ineffective if the concentration drops to half of the maximum concentration.

b) Will the patient be at risk of pregnancy if she forgets to take the pill one day? (0 1 1)

c) How about two days in a row? (0 1 1)