Arholiadau Ysgoloriaeth Ionawr 2019

Scholarship Examinations January 2019

Amser a ganiateir : 2 awr MATHEMATEG

Time allowed: 2 hours MATHEMATICS

*You may attempt any of the questions. Credit will be given for complete answers.*

[Assume *g* = 9.8 m.s-2]

1. The sum of the first 3 terms of an arithmetic series is 60 and the sum of the first 6 terms is 201. Find the sum of the first 9 terms.
What is the 11th term in the series?

2. Find all the solutions to the equation

3. Evaluate the definite integral

4. Find the equation of the normal to the circle

 from the point (9, 3), and the tangent to the circle at the point (10, 10).

5. Express

 in partial fractions.

6. Expand



 in ascending powers of *x*, up to the term in *x3*.

 For what values of *x* is the expansion valid?

 Find an approximation to the cube root of 1.01 using the first two terms of the expansion. How accurate is your approximation?

7. Rearrange the expression



 to yield an expression for *x*.

 Hence solve

8. The vertices *A*, *B*, *C* of a triangle have position vectors ***a***, ***b***, ***c***. Point *X* lies on the line *AB* such that *AX* : *XB* = 3 : 2. Write an expression for the position vector of *X* in terms of ***a***, ***b***, ***c***.

 Find, in terms of ***a***, ***b***, ***c,*** the position vector of point *P* which divides *XC* in the ratio

*XP* : *PC* = ** : 1 - **

9. A body of mass 7 kg is suspended from a light string. The string is looped over a frictionless pulley and the other end attached to a 5 kg mass on a frictionless plane inclined at 50 degrees to the horizontal. Draw a sketch of the system If the two masses are initially at rest, in which direction will the masses begin to move? How long will it take the vertically suspended mass to move 10 cm?

10. Solve the differential equation



 with initial condition .

11. The continuous random variable *X* has probability density function *f* defined by

 Find the parameter **, and the mean and standard deviation of *f*. Sketch the probability density function.

12. Three balls are chosen at random from a box containing 8 red balls, and 6 blue balls. Find the probability that

 a) two red balls and one blue ball are chosen (in some order)

 b) all three balls will be the same colour

13. The mass of chocolate in a chocolate bar comes from a normal distribution, with mean 65g and standard deviation 0.5g.

 Calculate the probability that a given chocolate bar has mass between 64.5g and 65.5g.