

 **MATHS METHODS 3 & 4**

 **TRIAL** **EXAMINATION 1**

 **SOLUTIONS**

 **2022**

# Question 1 (3 marks)

1. Let 

  (product rule)

**(1 mark)**

1. 



**(1 mark)**

**(1 mark)**

**Question 2** (2 marks)



**(1 mark)**

Given 

 

 **(1 mark)**

**Question 3** (4 marks)

1. The amplitude of *h* is 3 so the range is .  **(1 mark)**
2. Method 1



  **(1 mark)**

 

 **(1 mark)** correct value of *x* including correct categorisation of *n*

**(1 mark)** a second correct value of *x* including correct categorisation of *n*

Method 2



 



cos is positive in the 1st and 4th

quadrants and the base angle is

. **(1 mark)**

1st quadrant solution:

 

**(1 mark)** correct answer including correct categorisation of *n*

4th quadrant solution:


**(1 mark)** correct answer including correct categorisation of *n*

**Question 4** (4 marks)

1. 

 

**(1 mark)**

1. 



**(1 mark)**

 **(1 mark)**

1. The actual weight equals the advertised weight when the difference between the two is zero. From the table, .

Let *Y* be the random variable representing the number of packets of saffron in a sample of three for which the actual weight equals the advertised weight.

 ie 

 



**(1 mark)**

**Question 5** (7 marks)

1. The domain of *h* is 

 



**(1 mark)** for correct domain **(1 mark)** for correct range

1. Stationary points occur when .

 

Since  has no solutions then *h* has no stationary points.

**(1 mark)**



*x*-intercept occurs when 



*y*-intercept occurs when 



**(1 mark) –** correct asymptote **(1 mark)** – correct shape of graph

**(1 mark)** – correct axis intercepts

1. 

Let 

After a dilation by a factor of 3 from the *x*-axis, the rule becomes

 

After a translation in the positive direction of the *y*-axis (i.e. two units up), the rule becomes



 **(1 mark)**

**Question 6** (4 marks)

1. Let the angle that the graph of *g* makes with the positive branch of the *x*-axis be .



**(1 mark)**



Using your answer to part **a.** and the facts that

* angles along a straight line add to 180°
* angles in a triangle add to 180°
* vertically opposite angles are equal

then the angle that the tangent makes with the positive branch of the *x*-axis is 45°.

So the gradient of the tangent is .

**(1 mark)**

 

**(1 mark)**



 

but .

**(1 mark)**

**Question 7** (5 marks)

1. 



**(1 mark)**

1. Method 1 - using a probability table

|  |  |  |  |
| --- | --- | --- | --- |
|  | *A* |  |  |
| *B* | 2*p* |  |  |
|  | ***p*** | *p* | **2*p*** |
|  | **3*p*** |  | **1** |

The values in bold we are given specifically (ie ) or we have worked out in previous parts (ie ) or we can work out from what we are given i.e. if . **(1 mark)**

We can then calculate the other entries. So . **(1 mark)**

Method 2 – using a Venn diagram



 is shaded in the diagram.

The given value of *p* is in bold ie .

 from part **a.** so .**(1 mark)**



So 

  **(1 mark)**

1. 

 

**(1 mark)**

 **(1 mark)**

Note that from part **a.** and  so .

**Question 8** (6 marks)

1. 

 

**(1 mark)**

Since the function intersects , then it must pass through the point of intersection i.e. .  and so .

The rule of the function is .

**(1 mark)**

1. The area required is shaded in

the graph shown.



Note that the *x*-intercept of the

graph of  occurs

.

 



**(1 mark)**

**(1 mark)**

**(1 mark)**

**(1 mark)**

 **Question 9** (5 marks)

1. Method 1

Gradient of tangent

  **(1 mark)**

The tangent passes through  and .

Equation of tangent is

 

Since the tangent passes through , then

 

The equation of the tangent is  as required. **(1 mark)**

Method 2

Gradient of tangent

  **(1 mark)**

The tangent passes through  and  i.e. .



So 

 

 

The equation of the tangent is  as required. **(1 mark)**

Method 3

Gradient of tangent

 

The tangent passes through .

Equation of tangent is

 

**(1 mark)**

Since the tangent intersects with *f* just once then the equation of intersection of the tangent and *f* has just one solution.

  (equation of intersection)





For one solution, 





The equation of the tangent is 

 **(1 mark)**

1. Method 1 – algebraic approach

*r* is a dilation factor from the *y*-axis.

If  is an image point, then .





For one point of intersection,

 

 

 

  **(1 mark)**

If  won’t intersect.

We need also to consider the domain of *f* i.e..

There will be one point of intersection between *g* and *f* when the *x*-intercept of *g* lies between  and 2.

*x*-intercepts occur when 



We require

 

But 

**(1 mark)** for the interval involving 

**(1 mark)** for the exclusion of zero

Method 2 – graphical approach

When  we have the case shown on the graph in the question (and below), so *g* and *f* intersect just once in this case.

When  we have the case where the line has been reflected in the *y*-axis so the point of tangency will occur at , so *g* and *f* intersect just once in this case.



When we have a dilation from the *y*-axis which is a stretching.

This means that *g* would have no points of intersection with *f.*



When  we have a dilation from the *y*-axis which is a compression.

Note that the *x*-intercept of the line is  when . The *x*-intercept of *f* is 2.

When the line has been compressed towards the *y*-axis so that it’s *x*-intercept is also 2, the compression factor has been .

So for , the line intersects twice with *f*.

Similarly for , the line intersects twice with *f*.



For , the line intersects with *f* just once.

Similarly, for , the line intersects just once.



In summary, the required values of *r* are

.

**(1 mark) (1 mark) (1 mark)**