**Solutions**

**Ans1:**

1. **Given:**

The normal distribution of weights of the apples picked by Jane are as follows:

Percentage of apples that Jane picks and doesn’t like are:

The Z-score for the raw value is ,

Converting to standard normal variable,

From standard normal tables,

Hence, the required percentage

1. Now,

Percentage of apples are not liked by Jane

Therefore, 75th percentile of the weights of the apples that Jane likes would have a percentile:

Hence, is the percentile.

So, the probability of the weights more than equal to the above value:

Hence, the required probability

**Ans2:**

1. **Given:**

Number of Red Balls , Payoffs when you draw a ball:

Number of Blue Balls , If Yellow Ball is draw

Number of Green Balls , If Green Ball is draw

Number of Yellow Balls , If Blue Ball is draw ,

Number of Orange Balls , If Red Ball is draw ,

Total number of balls . If orange ball is draw

Probability of Red ball,

Probability of Blue ball,

Probability of Green ball,

Probability of Yellow ball,

Probability of Orange ball,

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Balls** | Red | Green | Blue | Yellow | Orange |
| **Probabilities** |  |  |  |  |  |
| **Payoffs** |  |  |  |  |  |

**Variance,**

**Standard Deviation,**

**Ans3:** Let,

The event Harry guesses the answer is correct,

Probability of Harry knows the answer,

Probability of Harry guesses the answer,

Probability of Harry answered the correctly, given that he knows the answer,

Probability of Harry answered the correctly, given that he guesses the answer,

Probability of Harry knows the answer, given that he answered it correctly,

Using Bayes’ theorem,

**The probability that Harry knows the correct answer to a problem given that he has**

**answered that problem correctly, .**

**Ans4:** Let,

The event that an email is detected as spam,

The event that an email is spam,

The event that an email is not spam.

Given:

Using Bayes’ formula:

**If an email is detected as spam, then the probability that it is in fact a non-spam email, *.***

**Ans5:** Let,

Positive Mammogram result is positive,

Negative Mammogram result is negative,

B Tumor is benign,

M Tumor is malignant.

Given,

**Therefore, the chances are patient has cancer .**

**Ans6:**

1. **Given:** , where are also functions of

**Limit Definition of :**

**Prove:**

Using the basic properties of limits to write this as,

The individual limits are,

Putting all the values in the limits,

**Hence Proved.**

1. **Given:**

**Limit Definition of :**

Using trigonometric formula of ,

Using the theorem, the limit of the sum of functions is equal to the sum of the limits of these functions to rewrite as follows:

Using the results of the limits of trigonometric functions,

Putting these values in the ,

**Ans7:** **Given:**

Using the product rule,

Slope of the tangent line at ,

Equation of a tangent line,

Using point slope form of line,

**The equation of a tangent line is** **.**

**Ans8:** **Given:**

Using Chain Rule,

Let ,

Using Derivative of the exponential, ,

Putting value back,

Using the Quotient Rule, ,

Using both Power Rule, is ,where and Difference rule,

Derivative of Constant is ,

**Ans9:**

Using

Using the Quotient Rule, ,

Using both Sum and Difference Rule,

Using Power Rule, is ,

Using Product Rule, ,

Using both Sum and Difference Rule,

Derivative of Constant is ,

Using Power Rule, is ,where ,

Using Power Rule, is ,where ,

Using Chain Rule,

Let

Using Power Rule, is ,where ,

Putting value back,

Using Power Rule, is ,where ,

Using Product Rule, ,

Using Chain Rule,

Let

Using Power Rule, is ,where ,

Putting back value,

Using Sum Rule,

Derivative of Constant is ,

Using Chain Rule,

Let

Using Power Rule, is ,where ,

Putting back value,

Using Difference Rule,

Derivative of Constant is ,

Using logarithmic differentiation technique,

Taking logarithm on ,

**LHS:**

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

**RHS:**

Using both Sum and Difference rule,

Derivative of natural logarithm is ,

Let ,

Putting back value,

Using both Sum and Difference rule,

Derivative of constant is .

Derivative of natural logarithm is ,

Let ,

Putting back value,

Derivative of natural logarithm is ,

Let ,

Derivative of the e is

Putting back value,

Using logarithmic differentiation technique,

Taking logarithm on ,

**LHS:**

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

**RHS:**

Using Constant multiple rule,

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

Using Difference Rule,

Derivative of Constant is ,

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

Using Difference Rule,

Derivative of Constant is ,

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

Using Difference Rule,

Derivative of Constant is ,

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

Using Difference Rule,

Derivative of Constant is ,

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,

Putting back value,

Using Difference Rule,

Derivative of Constant is ,

**Ans10:**

Taking partial derivative with respect to ,

Using Product Rule, ,

Using Chain Rule,

Let ,

Using Derivative of the exponential, ,

Using both Sum and Difference rule,

Putting back value,

Derivative of Constant is ,

Using Power Rule, is ,where ,

Taking partial derivative with respect to ,

Using both Sum and Difference Rule,

Derivative of Constant is ,

Using Power Rule, is ,where ,

Taking partial derivative with respect to ,

Using Difference Rule,

Using both Sum and Difference rule,

Using Power Rule, is ,where , ,

Derivative of constant is

Using Chain Rule,

Let ,

Derivative of natural logarithm is ,  
Derivative of constant is

Putting back value,

Taking partial derivative with respect to ,

Using Difference Rule,

Using both Sum and Difference Rule,

Derivative of Constant is

Using Power Rule, is ,where , ,

Using Product Rule, ,

Using Power Rule, is ,where , ,

Derivative of natural logarithm is ,

Let

Putting value back,

Using Sum Rule,

Derivative of Constant is

Taking partial derivative with respect to ,

Using Difference Rule,

Derivative of Constant is ,

Using Product Rule, ,

Using both Sum and Difference Rule,

Derivative of Constant is

Derivative of natural logarithm is ,

Let

Putting value back,

**Ans 11:** **Given:**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Hours after PM |  |  |  |  |  |  |  |
| Rainfall Depth |  |  |  |  |  |  |  |

1. Central difference for approximating the slope of rainfall depth using numerical differentiation at hour 12.5 and at hour 22.5,

1. The slope of rainfall depth at hour 15 using forward numerical differentiation,

1. The slope of rainfall depth at hour 15 using backward numerical differentiation,