

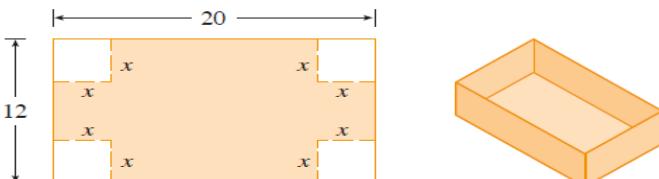
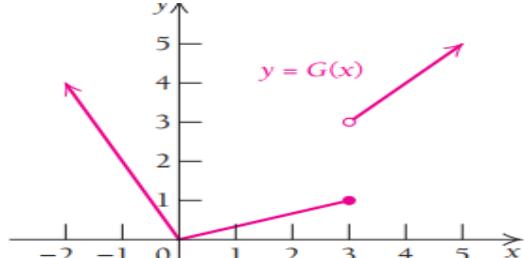
DEPARTMENT OF MATHEMATICS

Model_QP_ISA-I

Course Code: 24EMAB101

Course Title: Introduction to Calculus

Note: Answer any **TWO FULL** questions

Q.No	Questions	Marks											
1.	<p>a) A box with an open top is to be constructed from a rectangular piece of cardboard with dimensions 12 in. by 20 in. by cutting out equal squares of side x at each corner and then folding up the sides as in the figure. Express the volume V of the box as a function of x and hence find its domain</p> 	06											
	<p>b) Define horizontal and vertical asymptotes. Find the horizontal and vertical asymptotes of the functions (i) $y = \frac{x^2+1}{2x^2-3x-2}$ ii) $y = \frac{x^3-x}{x^2-6x+5}$</p>	07											
	<p>c) Graph the following function, by identifying its parent function and then applying the appropriate transformations. Also find domain and range $i) y = -x^3$ $ii) y = 4 - x^2$</p>	07											
2.	<p>a) From the given graph of $y = G(x)$ a) Find $\lim_{x \rightarrow 3^+} G(x)$ b) Find $\lim_{x \rightarrow 3^-} G(x)$ c) Find $\lim_{x \rightarrow 3} G(x)$ d) Find $G(3)$ e) Is G continuous at $x = 3$? Why or why not? f) Is G continuous at $x = 0$? Why or why not?</p> 	06											
	<p>b) The population P (in thousands) of a city from 1992 to 2000 is shown in the table. (Midyear estimates are given.)</p> <table border="1" data-bbox="285 1774 833 1864"> <tr> <th>Year</th> <th>1992</th> <th>1994</th> <th>1996</th> <th>1998</th> <th>2000</th> </tr> <tr> <th>P</th> <td>10,036</td> <td>10,109</td> <td>10,152</td> <td>10,175</td> <td>10,186</td> </tr> </table> <p>(a) Find the average rate of growth (i) from 1992 to 1996 (ii) from 1994 to 1996 (iii) from 1996 to 1998. In each case, include the units. (b) Estimate the instantaneous rate of growth in 1996 by taking the average of two average rates of change. What are its units?</p>	Year	1992	1994	1996	1998	2000	P	10,036	10,109	10,152	10,175	10,186
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	(c) Estimate the instantaneous rate of growth in 1996 by measuring the slope of a tangent.													
c	<p>a) The data in the table relate study time and test scores.</p> <p>b) Create a linear function to the data.</p> <p>c) Make a scatterplot of the data and super impose the linear function on the scatterplot.</p> <p>d) Use the linear model to predict the test score received when one has studied for 11 hr.</p>	<table border="1"> <thead> <tr> <th>Study Time (In Hrs)</th> <th>Test Grade (In percent)</th> </tr> </thead> <tbody> <tr> <td>7</td> <td>83</td> </tr> <tr> <td>8</td> <td>85</td> </tr> <tr> <td>9</td> <td>88</td> </tr> <tr> <td>10</td> <td>91</td> </tr> <tr> <td>11</td> <td>?</td> </tr> </tbody> </table>	Study Time (In Hrs)	Test Grade (In percent)	7	83	8	85	9	88	10	91	11	?
Study Time (In Hrs)	Test Grade (In percent)													
7	83													
8	85													
9	88													
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11	?													
3	<p>a) Use the graph of $y = f(x)$ to sketch the graph of its derivative $f'(x)$.</p>	06												
	<p>b) On Feb 10, 2023, high tide in Goa was at midnight. The water level at high tide was 9.9 feet; at low tide, it was 0.1 feet. Assuming the next high tide is at exactly 12 noon and that the height of the water is given by a sine or cosine curve, find a formula for the water level in Goa as a function of time.</p>	07												
	<p>c) Find the derivative of $h(x) = (2x + 1)^5 (3x - 2)^7$</p>	07												