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G12 Adv Term I (2024-25) End of Term (EoT) Questions

Justin Dsouza



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GI2 Adv Term I

Part 1: MCQ & Part 2 FRQ

EoTI 2024-25

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Number of MCQ عدد الأسئلة الموضوعية	15
Marks of MCQ درجة الأسئلة الموضوعية	4
Number of FRQ عدد الأسئلة المقالية	5
Marks per FRQ الدرجات للأسئلة المقالية	(5-10)
Type of All Questions نوع كافة الأسئلة	الأسئلة الموضوعية / MCQ الأسئلة المقالية / FRQ
Maximum Overall Grade الدرجة القصوى الممكنة	100
Exam Duration - مدة الامتحان	150 minutes
Mode of Implementation - طريقة التطبيق	SwiftAssess & Paper-Based
Calculator الآلة الحاسبة	Allowed مسموحة



Question*	Learning Outcome/Performance Criteria**	Reference(s) in the Student Book (English Version)	
		المرجع في كتاب الطالب (النسخة الانجليزية)	
		Example/Exercise	Page
السؤال *	نواتج التعلم / معايير الأداء **	مثال / تمرين	الصفحة
1	Estimate an arc length of a given function.	(7-12)	68
	تقدير طول القوس على منحنى دالة معطاة		
2	Find a limit algebraically or graphically, if it exists.	Example3	71
	إيجاد قيمة نهاية دالة ما جبريا وبيانيا، إن وجدت		
3	Find limits of polynomial, rational, and trigonometric functions using theorems.	(1-28)	85
	إيجاد نهاية الدوال كثيرة الحدود والنسبية والمثلثية باستخدام نظريات النهايات		
4	Find limits of polynomial, rational, and trigonometric functions using theorems.	Example3.7	81
	إيجاد نهاية الدوال كثيرة الحدود والنسبية والمثلثية باستخدام نظريات النهايات		
5	Find horizontal, vertical, and slant asymptotes using limits.	(23-32)	106
	إيجاد خطوط التقارب الأفقية والرأسية والمائلة باستخدام النهايات		
6	Sketch the graph of a function using the graph of its derivative.	(13-18)	151
	رسم منحنى الدالة اعتمادا على التمثيل البياني لمشتقتها		
7	Understand the relationship between continuity and differentiability.	(19-22)	151
	فهم العلاقة بين الاتصال والاشتقاق		



Question*		Learning Outcome/Performance Criteria**	Reference(s) in the Student Book (English Version)	
			المرجع في كتاب الطالب (النسخة الانجليزية)	
		السؤال *	ناتج التعلم / معايير الأداء**	Example/Exercise
			مثال/تمرين	الصفحة
	8	Find the average velocity and the instantaneous velocity at a given point.	(21-24)	161
		إيجاد السرعة المتوسطة والسرعة اللحظية عند نقطة معطاة		
	9	Apply the chain rule for differentiation	(31-38)	177
		تطبيق قاعدة السلسلة في الاشتقاق		
	10	Find the derivative of an inverse function using the Chain Rule.	(17-22)	176
		إيجاد مشتقة معكوس دالة باستخدام قاعدة السلسلة		
	11	Find the derivatives of trigonometric functions using differentiation rules.	(19-22)	184
		إيجاد مشتقات الدوال المثلثية باستخدام قواعد الاشتقاق		
	12	Find derivatives of natural logarithmic functions.	(1-14)	192
		إيجاد مشتقات الدوال اللوغاريتمية الطبيعية		
	13	Use implicit differentiation to find derivatives of inverse trigonometric functions.	(29-34)	204
		استخدام الاشتقاق الضمني في إيجاد مشتقات الدوال المثلثية العكسية		
	14	Find the linear approximation of a given function at a given point	(1-6)	234
		ايجاد التقريب الخطي لدالة معطاة عند نقطة		
	15	Use l'Hopital's rule to compute limits in various cases	(1-12)	247
		استخدم قاعدة لوبيتال لحساب النهايات في حالات مختلفة		

Question*	Learning Outcome/Performance Criteria**	Reference(s) in the Student Book (English Version)	
		المرجع في كتاب الطالب (النسخة الانجليزية)	
		Example/Exercise	Page
السؤال *	نواتج التعلم / معايير الأداء **	مثال / تمرين	الصفحة
الأسئلة المقالية - FRQ	16	a) Determine the continuity of a function at a given point. البحث في اتصال دالة عند نقطة معطاة a)	P95,96
		b) Find limits at infinity and limits that are infinite. إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية b)	107
	17	a) Find the derivative of a function at a given point. إيجاد المشتقة لدالة عند نقطة ما a) Write the equation of a tangent line using derivative اكتب معادلة الخط المماس باستخدام المشتقة	151
	18	Find derivatives implicitly. إيجاد المشتقات للعلاقات الضمنية	204
	19	Understand the Mean Value Theorem and use it in applications. التعرف على نظرية القيمة المتوسطة واستخدامها في التطبيقات	219
	20	Use l'Hopital's rule to compute limits in various cases استخدم قاعدة لوبيتال لحساب النهايات في حالات مختلفة	246





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Part I: MCQ

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Question 1

Estimate an arc length of a given function.

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Exercise 7 - 12

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In exercises 7–12, estimate the length of the curve $y = f(x)$ on the given interval using (a) $n = 4$ and (b) $n = 8$ line segments. (c) If you can program a calculator or computer, use larger n 's and conjecture the actual length of the curve.

7. $f(x) = \cos x, 0 \leq x \leq \pi/2$

8. $f(x) = \sin x, 0 \leq x \leq \pi/2$



In exercises 7–12, estimate the length of the curve $y = f(x)$ on the given interval using (a) $n = 4$ and (b) $n = 8$ line segments. (c) If you can program a calculator or computer, use larger n 's and conjecture the actual length of the curve.

9. $f(x) = \sqrt{x+1}, 0 \leq x \leq 3$

10. $f(x) = 1/x, 1 \leq x \leq 2$



In exercises 7–12, estimate the length of the curve $y = f(x)$ on the given interval using (a) $n = 4$ and (b) $n = 8$ line segments. (c) If you can program a calculator or computer, use larger n 's and conjecture the actual length of the curve.

11. $f(x) = x^2 + 1, -2 \leq x \leq 2$

12. $f(x) = x^3 + 2, -1 \leq x \leq 1$





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Solve By Yourself

**Any Questions/Doubts?
Ask them in the Comments!**

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Question 2

Find a limit algebraically or graphically, if it exists

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Example 3

YouTube



EXAMPLE 2.3 Determining Limits Graphically

Use the graph in Figure 2.8 to determine $\lim_{x \rightarrow 1^-} f(x)$, $\lim_{x \rightarrow 1^+} f(x)$, $\lim_{x \rightarrow 1} f(x)$ and $\lim_{x \rightarrow -1} f(x)$.

Solution For $\lim_{x \rightarrow 1^-} f(x)$, we consider the y -values as x gets closer to 1, with $x < 1$. That is, we follow the graph toward $x = 1$ *from the left* ($x < 1$). Observe that the graph dead-ends into the open circle at the point $(1, 2)$. Therefore, we say that $\lim_{x \rightarrow 1^-} f(x) = 2$. For $\lim_{x \rightarrow 1^+} f(x)$, we follow the graph toward $x = 1$ *from the right* ($x > 1$). In this case, the graph dead-ends into the solid circle located at the point $(1, -1)$. For this reason, we say that $\lim_{x \rightarrow 1^+} f(x) = -1$. Because $\lim_{x \rightarrow 1^-} f(x) \neq \lim_{x \rightarrow 1^+} f(x)$, we say that $\lim_{x \rightarrow 1} f(x)$ does not exist. Finally, we have that $\lim_{x \rightarrow -1} f(x) = 1$, since the graph approaches a y -value of 1 as x approaches -1 both from the left and from the right.

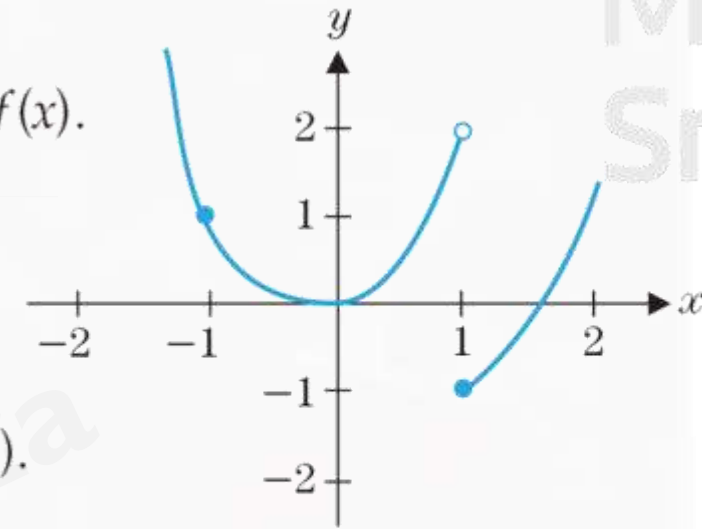


FIGURE 2.8

$y = f(x)$

$$\lim_{x \rightarrow 1^-} f(x) = 2, \quad \lim_{x \rightarrow 1^-} f(x) \neq \lim_{x \rightarrow 1^+} f(x), \quad \lim_{x \rightarrow -1} f(x) = 1$$

$$\lim_{x \rightarrow 1^+} f(x) = -1, \quad \lim_{x \rightarrow 1} f(x) \text{ does not exist}$$





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Question 3

Find limits of polynomial, rational, and trigonometric functions using theorems

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Exercise I - 28

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In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

1. $\lim_{x \rightarrow 0} (x^2 - 3x + 1)$

2. $\lim_{x \rightarrow 2} \sqrt[3]{2x + 1}$

3. $\lim_{x \rightarrow 0} \cos^{-1}(x^2)$

4. $\lim_{x \rightarrow 2} \frac{x - 5}{x^2 + 4}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

5. $\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x - 3}$

6. $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - 3x + 2}$

7. $\lim_{x \rightarrow 2} \frac{x^2 - x - 2}{x^2 - 4}$

8. $\lim_{x \rightarrow 1} \frac{x^3 - 1}{x^2 + 2x - 3}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

9. $\lim_{x \rightarrow 0} \frac{\sin x}{\tan x}$

10. $\lim_{x \rightarrow 0} \frac{\tan x}{x}$

11. $\lim_{x \rightarrow 0} \frac{x e^{-2x+1}}{x^2 + x}$

12. $\lim_{x \rightarrow 0} x^2 \csc^2 x$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

13. $\lim_{x \rightarrow 0} \frac{\sqrt{x+4} - 2}{x}$

14. $\lim_{x \rightarrow 0} \frac{2x}{3 - \sqrt{x+9}}$

15. $\lim_{x \rightarrow 1} \frac{x-1}{\sqrt{x}-1}$

16. $\lim_{x \rightarrow 4} \frac{x^3 - 64}{x - 4}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

17. $\lim_{x \rightarrow 1} \left(\frac{1}{x-1} - \frac{2}{x^2-1} \right)$

18. $\lim_{x \rightarrow 0} \left(\frac{2}{x} - \frac{2}{|x|} \right)$

19. $\lim_{x \rightarrow 0} \frac{1 - e^{2x}}{1 - e^x}$

20. $\lim_{x \rightarrow 0} \frac{\sin |x|}{x}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

21. $\lim_{x \rightarrow 2} f(x)$, where $f(x) = \begin{cases} 2x & \text{if } x < 2 \\ x^2 & \text{if } x \geq 2 \end{cases}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

22. $\lim_{x \rightarrow -1} f(x)$, where $f(x) = \begin{cases} x^2 + 1 & \text{if } x < -1 \\ 3x + 1 & \text{if } x \geq -1 \end{cases}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

$$23. \lim_{x \rightarrow -1} f(x), \text{ where } f(x) = \begin{cases} 2x + 1 & \text{if } x < -1 \\ 3 & \text{if } -1 < x < 1 \\ 2x + 1 & \text{if } x > 1 \end{cases}$$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

$$24. \lim_{x \rightarrow 1} f(x), \text{ where } f(x) = \begin{cases} 2x + 1 & \text{if } x < -1 \\ 3 & \text{if } -1 < x < 1 \\ 2x + 1 & \text{if } x > 1 \end{cases}$$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

25. $\lim_{h \rightarrow 0} \frac{(2 + h)^2 - 4}{h}$

26. $\lim_{h \rightarrow 0} \frac{(1 + h)^3 - 1}{h}$



In exercises 1–28, evaluate the indicated limit, if it exists. Assume that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

27. $\lim_{x \rightarrow 2} \frac{\sin(x^2 - 4)}{x^2 - 4}$

28. $\lim_{x \rightarrow 0} \frac{\tan x}{5x}$





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Question 4

Find limits of polynomial, rational, and trigonometric functions using theorems

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Example 3.7

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EXAMPLE 3.7 A Limit of a Product That Is Not the Product of the Limits

Evaluate $\lim_{x \rightarrow 0} (x \cot x)$.

Solution Your first reaction might be to say that this is a limit of a product and so, must be the product of the limits:

$$\begin{aligned} \lim_{x \rightarrow 0} (x \cot x) &= \left(\lim_{x \rightarrow 0} x \right) \left(\lim_{x \rightarrow 0} \cot x \right) \quad \text{This is incorrect!} \\ &= 0 \cdot ? = 0, \end{aligned} \quad (3.5)$$

where we've written a "?" since you probably don't know what to do with $\lim_{x \rightarrow 0} \cot x$.

Since the first limit is 0, do we really need to worry about the second limit? The problem here is that we are attempting to apply the result of Theorem 3.1 in a case where the hypotheses are not satisfied. Specifically, Theorem 3.1 says that the limit of a product is the product of the respective limits *when all of the limits exist*. The graph in Figure 2.16 suggests that $\lim_{x \rightarrow 0} \cot x$ does not exist. You should compute some function

values, as well, to convince yourself that this is in fact the case. Since equation (3.5)

does not hold and since none of our rules seem to apply here, we draw a graph (see Figure 2.17) and compute some function values. Based on these, we conjecture that

$$\lim_{x \rightarrow 0} (x \cot x) = 1,$$

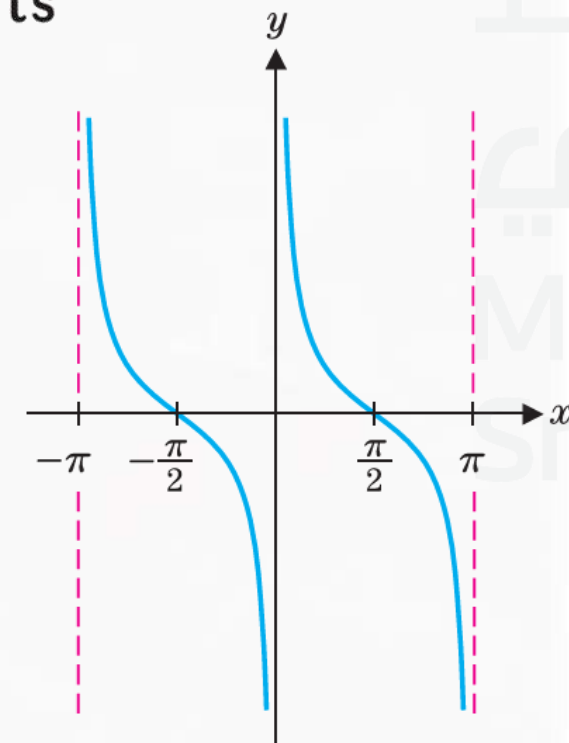


FIGURE 2.16

$y = \cot x$



EXAMPLE 3.7 A Limit of a Product That Is Not the Product of the Limits

Evaluate $\lim_{x \rightarrow 0} (x \cot x)$.

$$\lim_{x \rightarrow 0} (x \cot x) = 1,$$

which is definitely not 0, as you might have initially suspected. You can also think about this limit as follows:

$$\begin{aligned} \lim_{x \rightarrow 0} (x \cot x) &= \lim_{x \rightarrow 0} \left(x \frac{\cos x}{\sin x} \right) = \lim_{x \rightarrow 0} \left(\frac{x}{\sin x} \cos x \right) \\ &= \left(\lim_{x \rightarrow 0} \frac{x}{\sin x} \right) \left(\lim_{x \rightarrow 0} \cos x \right) \\ &= \frac{\lim_{x \rightarrow 0} \cos x}{\lim_{x \rightarrow 0} \frac{\sin x}{x}} = \frac{1}{1} = 1, \end{aligned}$$

since $\lim_{x \rightarrow 0} \cos x = 1$ and where we have used the conjecture

we made in example 2.6 that $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$.

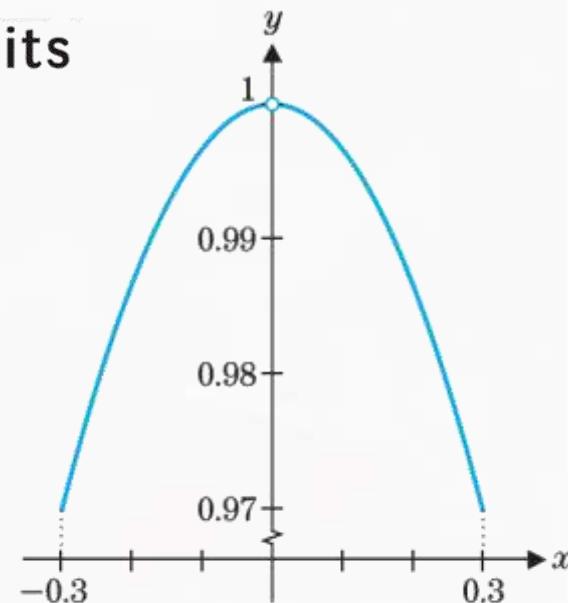


FIGURE 2.17

$$y = x \cot x$$

x	$x \cot x$
± 0.1	0.9967
± 0.01	0.999967
± 0.001	0.99999967
± 0.0001	0.9999999967
± 0.00001	0.999999999967





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Question 5

Find horizontal, vertical, and slant asymptotes using limits

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Exercise 23 - 32

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In exercises 23–28, determine all horizontal and vertical asymptotes. For each side of each vertical asymptote, determine whether $f(x) \rightarrow \infty$ or $f(x) \rightarrow -\infty$.

23. (a) $f(x) = \frac{x}{4 - x^2}$

(b) $f(x) = \frac{x^2}{4 - x^2}$



In exercises 23–28, determine all horizontal and vertical asymptotes. For each side of each vertical asymptote, determine whether $f(x) \rightarrow \infty$ or $f(x) \rightarrow -\infty$.

24. (a) $f(x) = \frac{x}{\sqrt{4 + x^2}}$

(b) $f(x) = \frac{x}{\sqrt{4 - x^2}}$



In exercises 23–28, determine all horizontal and vertical asymptotes. For each side of each vertical asymptote, determine whether $f(x) \rightarrow \infty$ or $f(x) \rightarrow -\infty$.

25. $f(x) = \frac{3x^2 + 1}{x^2 - 2x - 3}$

26. $f(x) = \frac{1 - x}{x^2 + x - 2}$



In exercises 23–28, determine all horizontal and vertical asymptotes. For each side of each vertical asymptote, determine whether $f(x) \rightarrow \infty$ or $f(x) \rightarrow -\infty$.

27. $f(x) = 4 \tan^{-1} x - 1$

28. $f(x) = \ln(1 - \cos x)$



In exercises 29–32, determine all vertical and slant asymptotes.

29. $y = \frac{x^3}{4 - x^2}$

30. $y = \frac{x^2 + 1}{x - 2}$



In exercises 29–32, determine all vertical and slant asymptotes.

31. $y = \frac{x^3}{x^2 + x - 4}$

32. $y = \frac{x^4}{x^3 + 2}$





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Question 6

Sketch the graph of a function using the graph of its derivative

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Exercise 13 - 18

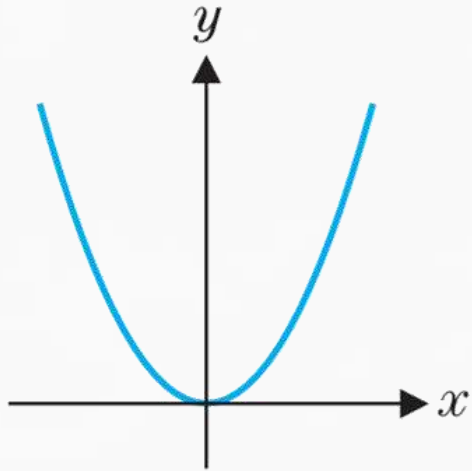
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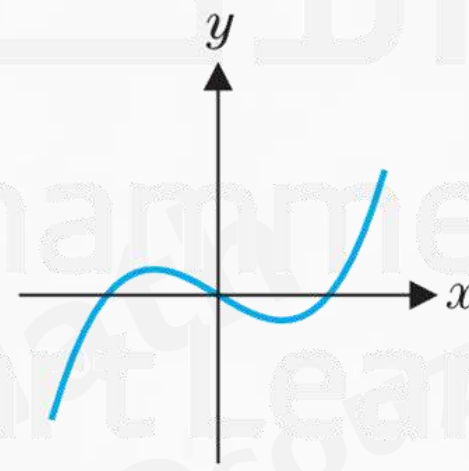
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In exercises 13–16, use the graph of f to sketch a graph of f' .

13. (a)

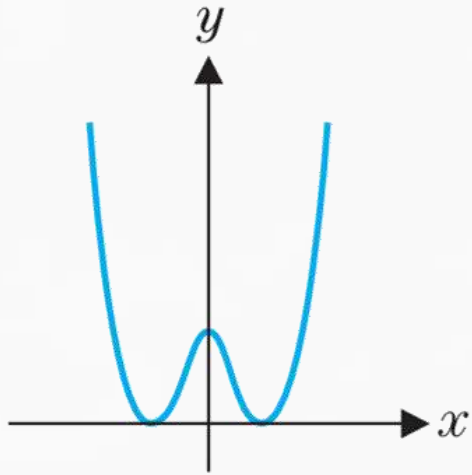


(b)

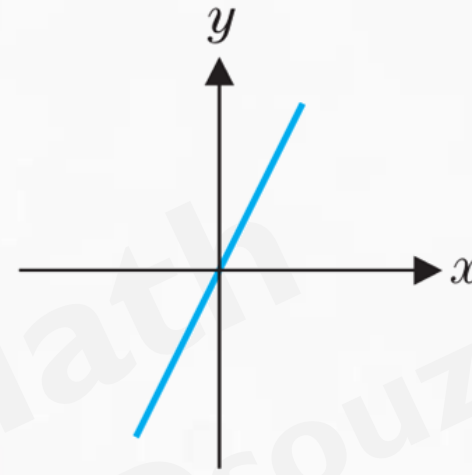


In exercises 13–16, use the graph of f to sketch a graph of f' .

14. (a)

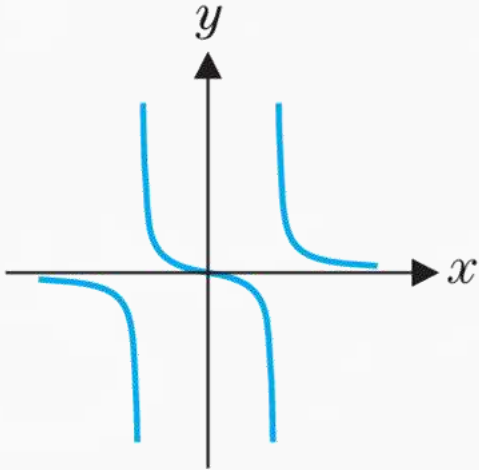


(b)

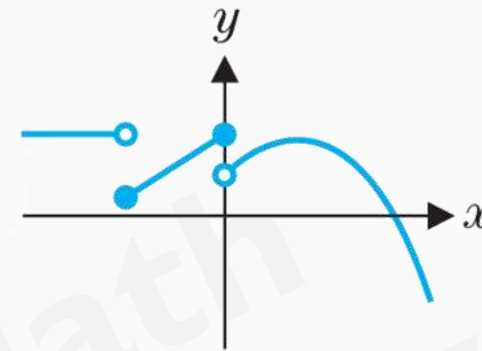


In exercises 13–16, use the graph of f to sketch a graph of f' .

15. (a)

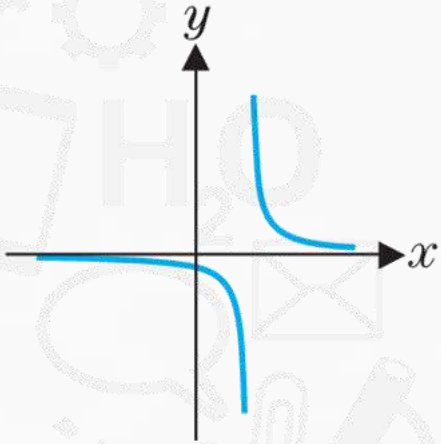


(b)

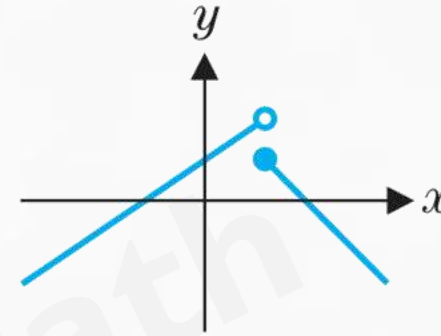


In exercises 13–16, use the graph of f to sketch a graph of f' .

16. (a)

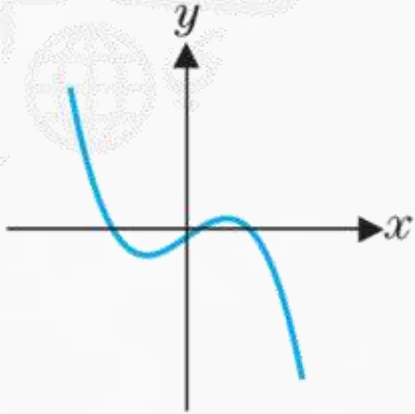


(b)

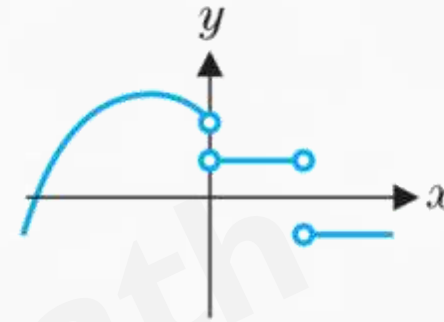


In exercises 17 and 18, use the given graph of f' to sketch a plausible graph of a continuous function f .

17. (a)

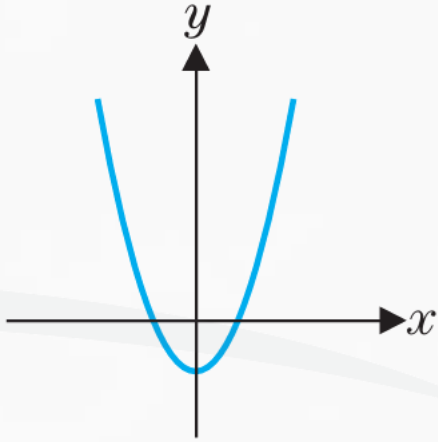


(b)

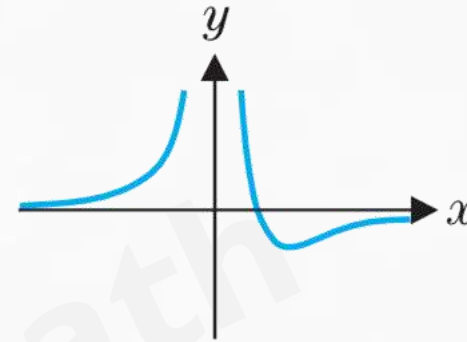


In exercises 17 and 18, use the given graph of f' to sketch a plausible graph of a continuous function f .

18. (a)



(b)





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Question 7

Understand the relationship between continuity and differentiability

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Exercise 19 - 22

YouTube



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Teacher

In exercises 19–22, compute the right-hand derivative

$$D_+f(0) = \lim_{h \rightarrow 0^+} \frac{f(h) - f(0)}{h} \quad \text{and the left-hand derivative}$$

$$D_-f(0) = \lim_{h \rightarrow 0^-} \frac{f(h) - f(0)}{h}. \text{ Does } f'(0) \text{ exist?}$$

$$19. f(x) = \begin{cases} 2x + 1 & \text{if } x < 0 \\ 3x + 1 & \text{if } x \geq 0 \end{cases}$$



In exercises 19–22, compute the right-hand derivative

$$D_+ f(0) = \lim_{h \rightarrow 0^+} \frac{f(h) - f(0)}{h} \quad \text{and the left-hand derivative}$$

$$D_- f(0) = \lim_{h \rightarrow 0^-} \frac{f(h) - f(0)}{h}. \text{ Does } f'(0) \text{ exist?}$$

$$20. f(x) = \begin{cases} 0 & \text{if } x < 0 \\ 2x & \text{if } x \geq 0 \end{cases}$$



In exercises 19–22, compute the right-hand derivative

$$D_+ f(0) = \lim_{h \rightarrow 0^+} \frac{f(h) - f(0)}{h} \quad \text{and the left-hand derivative}$$

$$D_- f(0) = \lim_{h \rightarrow 0^-} \frac{f(h) - f(0)}{h}. \text{ Does } f'(0) \text{ exist?}$$

$$21. f(x) = \begin{cases} x^2 & \text{if } x < 0 \\ x^3 & \text{if } x \geq 0 \end{cases}$$



In exercises 19–22, compute the right-hand derivative

$$D_+ f(0) = \lim_{h \rightarrow 0^+} \frac{f(h) - f(0)}{h} \quad \text{and the left-hand derivative}$$

$$D_- f(0) = \lim_{h \rightarrow 0^-} \frac{f(h) - f(0)}{h}. \text{ Does } f'(0) \text{ exist?}$$

$$22. f(x) = \begin{cases} 2x & \text{if } x < 0 \\ x^2 + 2x & \text{if } x \geq 0 \end{cases}$$

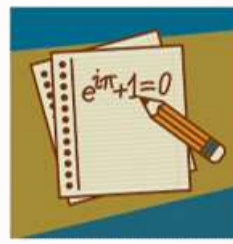




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Question 8

Find the average velocity and the instantaneous velocity at a given point

Page 161

Exercise 21 - 24

YouTube



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In exercises 21–24, use the given position function to find the velocity and acceleration functions.

21. $s(t) = -16t^2 + 40t + 10$



In exercises 21–24, use the given position function to find the velocity and acceleration functions.

22. $s(t) = -4.9t^2 + 12t - 3$



In exercises 21–24, use the given position function to find the velocity and acceleration functions.

23. $s(t) = \sqrt{t} + 2t^2$



In exercises 21–24, use the given position function to find the velocity and acceleration functions.

24. $s(t) = 10 - \frac{10}{t}$





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Question 9

Apply the chain rule for differentiation

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Exercise 31 - 38

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In exercises 31 and 32, use the relevant information to compute the derivative for $h(x) = f(g(x))$.

31. $h'(1)$, where $f(1) = 3, g(1) = 2, f'(1) = 4, f'(2) = 3,$
 $g'(1) = -2$ and $g'(3) = 5$



In exercises 31 and 32, use the relevant information to compute the derivative for $h(x) = f(g(x))$.

32. $h'(2)$, where $f(2) = 1, g(2) = 3, f'(2) = -1, f'(3) = -3,$
 $g'(1) = 2$ and $g'(2) = 4$



33. A function f is an **even function** if $f(-x) = f(x)$ for all x and is an **odd function** if $f(-x) = -f(x)$ for all x . Prove that the derivative of an even function is odd and the derivative of an odd function is even.



34. If the graph of a differentiable function f is symmetric about the line $x = a$, what can you say about the symmetry of the graph of f' ?



In exercises 35–38, find the derivative where f is an unspecified differentiable function.

35. (a) $f(x^2)$

(b) $[f(x)]^2$

(c) $f(f(x))$



In exercises 35–38, find the derivative where f is an unspecified differentiable function.

36. (a) $f(\sqrt{x})$

(b) $\sqrt{f(x)}$

(c) $f(xf(x))$



In exercises 35–38, find the derivative where f is an unspecified differentiable function.

37. (a) $f(1/x)$

(b) $1/f(x)$

(c) $f\left(\frac{x}{f(x)}\right)$



In exercises 35–38, find the derivative where f is an unspecified differentiable function.

38. (a) $1 + f(x^2)$

(b) $[1 + f(x)]^2$

(c) $f(1 + f(x))$





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Question 10

Find the derivative of an inverse function
using the Chain Rule

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Exercise 17 - 22

YouTube



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.

17. $f(x) = x^3 + 4x - 1, a = -1$



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.

18. $f(x) = x^5 + 4x - 2, a = -2$



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.

19. $f(x) = x^5 + 3x^3 + x, a = 5$



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.

20. $f(x) = x^3 + 2x + 1, a = -2$



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.

21. $f(x) = \sqrt{x^3 + 2x + 4}$, $a = 2$



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.

22. $f(x) = \sqrt{x^5 + 4x^3 + 3x + 1}, a = 3$



In exercises 17–22, f has an inverse g . Use Theorem 5.2 to find $g'(a)$.



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Question 11

Find the derivatives of trigonometric functions using differentiation rules

Page 184

Exercise 19 - 22

YouTube



In exercises 19–22, find the derivative of each function.

19. (a) $f(x) = \sin x^2$

(b) $f(x) = \sin^2 x$

(c) $f(x) = \sin 2x$



In exercises 19–22, find the derivative of each function.

20. (a) $f(x) = \cos \sqrt{x}$

(b) $f(x) = \sqrt{\cos x}$

(c) $f(x) = \cos \frac{1}{2}x$



In exercises 19–22, find the derivative of each function.

21. (a) $f(x) = \sin x^2 \tan x$

(b) $f(x) = \sin^2(\tan x)$

(c) $f(x) = \sin(\tan^2 x)$



In exercises 19–22, find the derivative of each function.

22. (a) $f(x) = \sec x^2 \tan x^2$

(b) $f(x) = \sec^2(\tan x)$

(c) $f(x) = \sec(\tan^2 x)$





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Question 12

Find derivatives of natural logarithmic functions

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Exercise 1 - 14

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In exercises 1–24, differentiate each function.

1. $f(x) = x^3 e^x$

2. $f(x) = e^{2x} \cos 4x$



In exercises 1–24, differentiate each function.

3. $f(t) = t + 2^t$

4. $f(t) = t4^{3t}$



In exercises 1–24, differentiate each function.

5. $f(x) = 2e^{4x+1}$

6. $f(x) = (1/e)^x$



In exercises 1–24, differentiate each function.

7. $h(x) = (1/3)^{x^2}$

8. $h(x) = 4^{-x^2}$



In exercises 1–24, differentiate each function.

9. $f(u) = e^{u^2+4u}$

10. $f(u) = 3e^{\tan u}$



In exercises 1–24, differentiate each function.

11. $f(w) = \frac{e^{4w}}{w}$

12. $f(w) = \frac{w}{e^{6w}}$



In exercises 1–24, differentiate each function.

13. $f(x) = \ln 2x$

14. $f(x) = \ln \sqrt{8x}$





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Question 13

Use implicit differentiation to find derivatives
of inverse trigonometric functions

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Exercise 29 - 34

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In exercises 29–34, find the derivative of the given function.

29. (a) $f(x) = \sin^{-1}(x^3 + 1)$

(b) $f(x) = \sin^{-1}(\sqrt{x})$



In exercises 29–34, find the derivative of the given function.

30. (a) $f(x) = \cos^{-1}(x^2 + x)$

(b) $f(x) = \cos^{-1}(2/x)$



In exercises 29–34, find the derivative of the given function.

31. (a) $f(x) = \tan^{-1}(\sqrt{x})$

(b) $f(x) = \tan^{-1}(1/x)$



In exercises 29–34, find the derivative of the given function.

32. (a) $f(x) = \sqrt{2 + \tan^{-1} x}$

(b) $f(x) = e^{\tan^{-1} x}$



In exercises 29–34, find the derivative of the given function.

33. (a) $f(x) = 4 \sec(x^4)$

(b) $f(x) = 4 \sec^{-1}(x^4)$



In exercises 29–34, find the derivative of the given function.

34. (a) $f(x) = \sin^{-1}(1/x)$

(b) $f(x) = \csc^{-1}x$





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Question 14

Find the linear approximation of a given function at a given point

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Exercise 1 - 6

YouTube



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In exercises 1–6, find the linear approximation to $f(x)$ at $x = x_0$.

Use the linear approximation to estimate the given number.

3. $f(x) = \sqrt{2x + 9}, x_0 = 0, \sqrt{8.8}$

4. $f(x) = 2/x, x_0 = 1, 2/0.99$



In exercises 1–6, find the linear approximation to $f(x)$ at $x = x_0$.

Use the linear approximation to estimate the given number.

1. $f(x) = \sqrt{x}, x_0 = 1, \sqrt{1.2}$

2. $f(x) = (x + 1)^{1/3}, x_0 = 0, \sqrt[3]{1.2}$



In exercises 1–6, find the linear approximation to $f(x)$ at $x = x_0$.

Use the linear approximation to estimate the given number.

5. $f(x) = \sin 3x, x_0 = 0, \sin(0.3)$

6. $f(x) = \sin x, x_0 = \pi, \sin(3.0)$





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Question 15

Use L'Hôpital's rule to compute limits in various cases

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Exercise 1 - 12

YouTube



In exercises 1–40, find the indicated limits.

1. $\lim_{x \rightarrow -2} \frac{x + 2}{x^2 - 4}$

2. $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x^2 - 3x + 2}$



In exercises 1–40, find the indicated limits.

3. $\lim_{x \rightarrow \infty} \frac{3x^2 + 2}{x^2 - 4}$

4. $\lim_{x \rightarrow -\infty} \frac{x + 1}{x^2 + 4x + 3}$



In exercises 1–40, find the indicated limits.

5. $\lim_{t \rightarrow 0} \frac{e^{2t} - 1}{t}$

6. $\lim_{t \rightarrow 0} \frac{\sin t}{e^{3t} - 1}$



In exercises 1–40, find the indicated limits.

7. $\lim_{t \rightarrow 0} \frac{\tan^{-1} t}{\sin t}$

8. $\lim_{t \rightarrow 0} \frac{\sin t}{\sin^{-1} t}$



In exercises 1–40, find the indicated limits.

9. $\lim_{x \rightarrow \pi} \frac{\sin 2x}{\sin x}$

10. $\lim_{x \rightarrow -1} \frac{\cos^{-1} x}{x^2 - 1}$



In exercises 1–40, find the indicated limits.

11. $\lim_{x \rightarrow 0} \frac{\sin x - x}{x^3}$

12. $\lim_{x \rightarrow 0} \frac{\tan x - x}{x^3}$





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G12 Adv Term I

Part 2: Writing (FRQ)

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Question 16

a) Determine the continuity of a function at a given point & b) Find limits at infinity and limits that are infinite

Page 95,96 & 107

Exercise 29-32, 39-41 & 67-71

YouTube



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

29. Suppose that a state's income tax code states that the tax liability on x dirhams of taxable

$$\text{income is given by } T(x) = \begin{cases} 0 & \text{if } x \leq 0 \\ 0.14x & \text{if } 0 < x < 10,000 \\ c + 0.21x & \text{if } 10,000 \leq x. \end{cases}$$

Determine the constant c that makes this function continuous for all x . Give a rationale why such a function should be continuous.



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	a) البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	b) إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

30. Suppose a state's income tax code states that tax liability is 12% on the first AED 20,000 of taxable earnings and 16% on the remainder. Find constants a and b for the tax function

$$T(x) = \begin{cases} 0 & \text{if } x \leq 0 \\ a + 0.12x & \text{if } 0 < x \leq 20,000 \\ b + 0.16(x - 20,000) & \text{if } x > 20,000 \end{cases} \quad \text{such that } T(x) \text{ is continuous for all } x.$$



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

31. In example 4.8, find b and c to complete the table.



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

32. In example 4.8, show that $T(x)$ is continuous for $x = 6000$.



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	a) البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	b) إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

In exercises 39–41, determine values of a and b that make the given function continuous.

$$39. f(x) = \begin{cases} \frac{2 \sin x}{x} & \text{if } x < 0 \\ a & \text{if } x = 0 \\ b \cos x & \text{if } x > 0 \end{cases}$$



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	a) البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	b) إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

In exercises 39–41, determine values of a and b that make the given function continuous.

$$40. f(x) = \begin{cases} ae^x + 1 & \text{if } x < 0 \\ \sin^{-1} \frac{x}{2} & \text{if } 0 \leq x \leq 2 \\ x^2 - x + b & \text{if } x > 2 \end{cases}$$



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	a) البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	b) إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

In exercises 39–41, determine values of a and b that make the given function continuous.

$$41. f(x) = \begin{cases} a(\tan^{-1} x + 2) & \text{if } x < 0 \\ 2e^{bx} + 1 & \text{if } 0 \leq x \leq 3 \\ \ln(x - 2) + x^2 & \text{if } x > 3 \end{cases}$$



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	a) البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	b) إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

67. Suppose that the length of a small animal t days after birth is $h(t) = \frac{300}{1 + 9(0.8)^t}$ mm. What is the length of the animal at birth? What is the eventual length of the animal (i.e., the length as $t \rightarrow \infty$)?



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

68. Suppose that the length of a small animal t days after birth is $h(t) = \frac{100}{2 + 3(0.4)^t}$ mm. What is the length of the animal at birth? What is the eventual length of the animal (i.e., the length as $t \rightarrow \infty$)?



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	a) البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	b) إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

69. Suppose an object with initial velocity $v_0 = 0$ ft/s and (constant) mass m slugs is accelerated by a constant force F pounds for t seconds. According to Newton's laws of motion, the object's speed will be $v_N = Ft/m$. According to Einstein's theory of relativity, the object's speed will be $v_E = Fct/\sqrt{m^2c^2 + F^2t^2}$, where c is the speed of light. Compute $\lim_{t \rightarrow \infty} v_N$ and $\lim_{t \rightarrow \infty} v_E$.



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

70. After an injection, the concentration of the medicine in a muscle varies according to a function of time $f(t)$. Suppose that t is measured in hours and $f(t) = e^{-0.02t} - e^{-0.42t}$. Find the limit of $f(t)$ both as $t \rightarrow 0$ and $t \rightarrow \infty$, and interpret both limits in terms of the concentration of the drug.



16	a) Determine the continuity of a function at a given point.	(29-32)&(39-41)	P95,96
	البحث في اتصال دالة عند نقطة معطاة		
	b) Find limits at infinity and limits that are infinite.	(67-71)	107
	إيجاد النهايات التي تؤول إلى اللانهاية والنهايات عند اللانهاية		

71. Ignoring air resistance, the maximum height reached by a rocket launched with initial velocity v_0 is

$$h = \frac{v_0^2 R}{19.6R - v_0^2} \text{ m/s, where } R \text{ is the radius of the earth. In this exercise, we interpret this as a function of } v_0.$$

Explain why the domain of this function must be restricted to $v_0 \geq 0$. There is an additional restriction.

Find the (positive) value v_e such that h is undefined. Sketch a possible graph of h with $0 \leq v_0 < v_e$

and discuss the significance of the vertical asymptote at v_e . Explain why v_e is called the **escape velocity**.





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Question 17

a) Find the derivative of a function at a given point & b) Write the equation of a tangent line using derivative

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Exercise 1 - 12

YouTube



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 1–4, compute $f'(a)$ using the limits (2.1) and (2.2).

1. $f(x) = 3x + 1, a = 1$



17	a) Find the derivative of a function at a given point. إيجاد المشتقة لدالة عند نقطة ما Write the equation of a tangent line using derivative اكتب معادلة الخط المماس باستخدام المشتقة	(1-12)	151
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In exercises 1–4, compute $f'(a)$ using the limits (2.1) and (2.2).

2. $f(x) = 3x^2 + 1, a = 1$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 1–4, compute $f'(a)$ using the limits (2.1) and (2.2).

3. $f(x) = \sqrt{3x + 1}, a = 1$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 1–4, compute $f'(a)$ using the limits (2.1) and (2.2).

4. $f(x) = \frac{3}{x+1}, a = 2$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

5. $f(x) = 3x^2 + 1$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

6. $f(x) = x^2 - 2x + 1$



17	a) Find the derivative of a function at a given point. a) إيجاد المشتقة لدالة عند نقطة ما Write the equation of a tangent line using derivative اكتب معادلة الخط المماس باستخدام المشتقة	(1-12)	151
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In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

7. $f(x) = x^3 + 2x - 1$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

8. $f(x) = x^4 - 2x^2 + 1$



17	a) Find the derivative of a function at a given point. a) إيجاد المشتقة لدالة عند نقطة ما Write the equation of a tangent line using derivative اكتب معادلة الخط المماس باستخدام المشتقة	(1-12)	151
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In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

9. $f(x) = \frac{3}{x+1}$



17	a) Find the derivative of a function at a given point. a) إيجاد المشتقة لدالة عند نقطة ما Write the equation of a tangent line using derivative اكتب معادلة الخط المماس باستخدام المشتقة	(1-12)	151
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In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

10. $f(x) = \frac{2}{2x - 1}$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

11. $f(t) = \sqrt{3t + 1}$



17	a) Find the derivative of a function at a given point.	(1-12)	151
	إيجاد المشتقة لدالة عند نقطة ما a)		
	Write the equation of a tangent line using derivative		
	اكتب معادلة الخط المماس باستخدام المشتقة		

In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).

12. $f(t) = \sqrt{2t + 4}$



17	a) Find the derivative of a function at a given point. إيجاد المشتقة لدالة عند نقطة ما Write the equation of a tangent line using derivative اكتب معادلة الخط المماس باستخدام المشتقة	(1-12)	151
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In exercises 5–12, compute the derivative function f' using (2.1) or (2.2).



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Question 18

Find derivatives implicitly

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Exercise 5 - 16

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Teacher

In exercises 5–16, find the derivative $y'(x)$ implicitly.

5. $x^2y^2 + 3y = 4x$

6. $3xy^3 - 4x = 10y^2$



In exercises 5–16, find the derivative $y'(x)$ implicitly.

7. $\sqrt{xy} - 4y^2 = 12$

8. $\sin xy = x^2 - 3$



In exercises 5–16, find the derivative $y'(x)$ implicitly.

9. $\frac{x+3}{y} = 4x + y^2$

10. $3x + y^3 - \frac{4y}{x+2} = 10x^2$



In exercises 5–16, find the derivative $y'(x)$ implicitly.

11. $e^{x^2y} - e^y = x$

12. $xe^y - 3y \sin x = 1$



In exercises 5–16, find the derivative $y'(x)$ implicitly.

13. $y^2 \sqrt{x+y} - 4x^2 = y$

14. $x \cos(x+y) - y^2 = 8$



In exercises 5–16, find the derivative $y'(x)$ implicitly.

15. $e^{4y} - \ln(y^2 + 3) = 2x$

16. $e^{x^2}y - 3\sqrt{y^2 + 2} = x^2 + 1$





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Question 19

Understand the Mean Value Theorem and use it in applications

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Exercise 1 - 6

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Teacher

In exercises 1–6, check the hypotheses of Rolle's Theorem and the Mean Value Theorem and find a value of c that makes the appropriate conclusion true. Illustrate the conclusion with a graph.

1. $f(x) = x^2 + 1, [-2, 2]$

2. $f(x) = x^2 + 1, [0, 2]$



In exercises 1–6, check the hypotheses of Rolle's Theorem and the Mean Value Theorem and find a value of c that makes the appropriate conclusion true. Illustrate the conclusion with a graph.

3. $f(x) = x^3 + x^2, [0, 1]$

4. $f(x) = x^3 + x^2, [-1, 1]$



In exercises 1–6, check the hypotheses of Rolle's Theorem and the Mean Value Theorem and find a value of c that makes the appropriate conclusion true. Illustrate the conclusion with a graph.

5. $f(x) = \sin x, [0, \pi/2]$

6. $f(x) = \sin x, [-\pi, 0]$





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Question 20

Use L'Hôpital's rule to compute limits in various cases

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Exercise 30 - 40

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In exercises 1–40, find the indicated limits.

30. $\lim_{x \rightarrow 0^+} \frac{\sqrt{x}}{\ln x}$



In exercises 1–40, find the indicated limits.

31. $\lim_{x \rightarrow \infty} (\sqrt{x^2 + 1} - x)$



In exercises 1–40, find the indicated limits.

32. $\lim_{x \rightarrow \infty} (\ln x - x)$



In exercises 1–40, find the indicated limits.

33. $\lim_{x \rightarrow \infty} \left(1 + \frac{1}{x}\right)^x$



In exercises 1–40, find the indicated limits.

34. $\lim_{x \rightarrow \infty} \left| \frac{x+1}{x-2} \right|^{\sqrt{x^2-4}}$



In exercises 1–40, find the indicated limits.

35. $\lim_{x \rightarrow 0^+} \left(\frac{1}{\sqrt{x}} - \sqrt{\frac{x}{x+1}} \right)$



In exercises 1–40, find the indicated limits.

36. $\lim_{x \rightarrow 1} \frac{\sqrt{5-x}-2}{\sqrt{10-x}-3}$



In exercises 1–40, find the indicated limits.

37. $\lim_{x \rightarrow 0^+} (1/x)^x$



In exercises 1–40, find the indicated limits.

38. $\lim_{x \rightarrow 0^+} (\cos x)^{1/x}$



In exercises 1–40, find the indicated limits.

39. $\lim_{t \rightarrow \infty} \left(\frac{t-3}{t+2} \right)^t$



In exercises 1–40, find the indicated limits.

40. $\lim_{t \rightarrow \infty} \left(\frac{t-3}{2t+1} \right)^t$

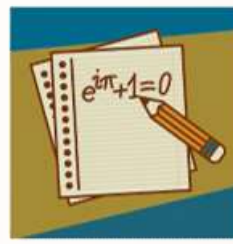




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Thank you

**Any Questions/Doubts?
Ask them in the Comments!**

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