هيكل امتحان نهاية الفصل المتقدم



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ⇦ المناهج الإماراتية ⇦ الصف الثاني عشر المتقدم ⇦ رياضيات ⇦ الفصل الأول ⇦ ملفات متنوعة ⇦ الملف

تاريخ إضافة الملف على موقع المناهج: 2026-11-15 21:13:37

المزيد من مادة رياضيات:	ملفات ا كتب للمعلم ا كتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي ا للمدرس

التواصل الاجتماعي بحسب الصف الثاني عشر المتقدم

صفحة المناهج الإماراتية على فيسبوك					
المواد على تلغرام	التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات	

المزيد من الملفات بحسب الصف الثاني عشر المتقدم والمادة رياضيات في الفصل الأول

1	هيكل
2	اختبار إلكتروني في النهايات والاتصال والتفاضل – اختيار من متعدد
3	أسئلة الهيكل الوزاري الجزء الكتابي في اتصال دالة عند نقطة معطاة بدون حل (غير محلول)
4	أسئلة الهيكل الوزاري – الجزء الكتابي مع الحل في اتصال الدالة
5	أسئلة الهيكل الوزاري – الجزء الإلكتروني (البنود 11-20)

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End of Term 1 Exam Structure

Mathematics – Grade 12 Advanced

A comprehensive question bank aligned with the learning outcomes

142 Multiple-Choice • 34 Free-Response • 26 Learning Outcomes

Unit 2: Limits and Continuity • Unit 3: Differentiation

Academic Year 2026 – 2027

Student Name : .....

Class : ..... **Score :** .....

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Learning Outcomes Structure – End of Term 1 Exam – Mathematics Grade 12 Advanced

Number of questions: 26 **Maximum grade: 100** **Exam duration: 150 minutes**

Marks per question: 2 or 4 **Scientific calculator: Allowed** **Mode: Electronic & Paper**

Multiple-Choice Questions (1 – 20)

1 : **Estimate an arc length of a given function** — p. 68 — Exercises 7–12

2 : **Find a limit algebraically or graphically, if it exists** — p. 85 — Exercises 21–24

3 : **Use the squeeze theorem to find limits** — p. 85 — Exercises 29–32

4 : **Find limits for polynomials, rational, and trigonometric functions using theorems** — p. 85 — Exercises 7–16

5 : **Study the continuity of a function at a given point** — p. 95 — Exercises 21–28

6 : **Use the continuity properties to study the continuity of a function or a composition of functions at a given point** — p. 89 — Example 4.2

7 : **Find infinite limits and limits at infinity** — p. 106 — Exercises 9–14

8 : **Find the average and instantaneous velocity at a given point** — p. 141 — Exercises 19–22

9 : **Sketch the graph of a function using that of its derivative** — p. 147 — Example 2.5

10 : **Find the derivative of a function at a given point** — p. 152 — Exercises 29–30

11 : **Find the derivative of a function using the Power Rule at a given point** — p. 160 — Exercises 7–14

12 : **Applying the rules of multiplication and division to derivatives** — p. 169 — Exercises 21–24

13 : **Apply the chain rule for differentiation** — p. 177 — Exercises 31–36

14 : **Find the derivative of an inverse function using the Chain Rule** — p. 176 — Exercises 17–22

15 : **Find the derivatives of trigonometric functions using differentiation rules** — p. 184 — Exercises 9–18

16 : **Find the derivatives of exponential functions** — p. 194 — Exercises 29–30

17 : **Find the derivatives of natural logarithmic functions** — p. 193 — Exercises 20–22

18 : **Find derivatives implicitly** — p. 198 — Example 8.2

19 : **Use implicit differentiation to find derivatives of inverse trigonometric functions** — p. 204 — Exercises 29–32

20 : **Recall the hypotheses of Rolle's Theorem** — p. 213 — Rolle's Theorem 10.1

Free-Response Questions (21 – 26)

21 : **a) Determine the continuity of a function at a given point b) Use the continuity properties to study the continuity of a function or a composition of functions at a given point** — p. 88 — Definition 4.1 , p. 95 — Exercises 29–32

22 : **Find horizontal, vertical, and slant asymptotes using limits** — p. 106 — Exercises 29–32

23 : **Apply the Product Rule on derivatives** — p. 169 — Exercises 17–20

24 : **Find the derivatives of trigonometric functions using differentiation rules** — p. 184 — Exercises 3–8

25 : **Solve real-life problems using derivatives of exponential and logarithmic functions** — p. 194 — Exercises 35–38

26 : **Understand the Mean Value Theorem and use it in applications** — p. 219 — Exercises 1–6

Part 1 : Multiple-Choice Questions (1 – 20)

Question 1 : Estimate an arc length of a given function

Bridge (English) p. 68 — Exercises 7–12

7 Estimate the length of the curve $y = f(x)$, $f(x) = cosx$, $0 \le x \le \frac{\pi}{2}$, using $n = 4$ line segments.

(a) 1.9033
(b) 1.9101
(c) 1.8950
(d) 1.9063

8 Estimate the length of the curve $y = f(x)$, $f(x) = sinx$, $0 \le x \le \frac{\pi}{2}$, using $n = 4$ line segments.

(a) 1.9101
(b) 1.8950
(c) 1.9033
(d) 1.9063

9 Estimate the length of the curve $y = f(x)$, $f(x) = \sqrt{x+1}$, $0 \le x \le 3$, using $n = 4$ line segments.

(a) 3.1660
(b) 3.1673
(c) 3.1670
(d) 3.1678

10 Estimate the length of the curve $y = f(x)$, $f(x) = \frac{1}{x}$, $1 \le x \le 2$, using $n = 4$ line segments.

(a) 1.1302
(b) 1.1280
(c) 1.1310
(d) 1.1321

11 Estimate the length of the curve $y = f(x)$, $f(x) = x^2 + 1,\ -2 \le x \le 2$, using $n = 4$ line segments.

(a) $2\sqrt{10} + 2\sqrt{2}$

(b) $\frac{8\sqrt{73}}{9} + \frac{4}{3}$

(c) $2\sqrt{10} + \sqrt{2}$

(d) $4\sqrt{5}$

12 Estimate the length of the curve $y = f(x)$, $f(x) = x^3 + 2,\ -1 \le x \le 1$, using $n = 4$ line segments.

(a) $\frac{\sqrt{65}+\sqrt{17}}{8}$

(b) $2\sqrt{2}$

(c) $\frac{20\sqrt{10}+2\sqrt{82}}{27}$

(d) $\frac{\sqrt{65}+\sqrt{17}}{4}$

7 Estimate the length of the curve $y = f(x)$, $f(x) = cosx,\ 0 \le x \le \frac{\pi}{2}$, using $n = 2$ line segments.

(a) 1.9101

(b) 1.9063

(c) 1.8950

(d) 1.9033

8 Estimate the length of the curve $y = f(x)$, $f(x) = sinx,\ 0 \le x \le \frac{\pi}{2}$, using $n = 3$ line segments.

(a) 1.9101

(b) 1.9033

(c) 1.9063

(d) 1.8950

9 Estimate the length of the curve $y = f(x)$, $f(x) = \sqrt{x+1},\ 0 \le x \le 3$, using $n = 2$ line segments.

(a) 3.1660

(b) 3.1678

(c) 3.1670

(d) 3.1673

10 Estimate the length of the curve $y = f(x)$, $f(x) = \frac{1}{x}$, $1 \le x \le 2$, using $n = 3$ line segments.

(a) 1.1321

(b) 1.1310

(c) 1.1302

(d) 1.1280

11 Estimate the length of the curve $y = f(x)$, $f(x) = x^2 + 1$, $-2 \le x \le 2$, using $n = 2$ line segments.

(a) $\frac{8\sqrt{73}}{9} + \frac{4}{3}$

(b) $4\sqrt{5}$

(c) $2\sqrt{10} + 2\sqrt{2}$

(d) $2\sqrt{5}$

12 Estimate the length of the curve $y = f(x)$, $f(x) = x^3 + 2$, $-1 \le x \le 1$, using $n = 3$ line segments.

(a) $\frac{20\sqrt{10}+2\sqrt{82}}{27}$

(b) $2\sqrt{2}$

(c) $\frac{\sqrt{65}+\sqrt{17}}{4}$

(d) $\frac{10\sqrt{10}+2\sqrt{82}}{27}$

Question 2 : Find a limit algebraically or graphically, if it exists

Bridge (English) p. 85 — Exercises 21–24

21 Find $\lim_{x\to 2} f(x)$, where $f(x) = \begin{cases} 2x, & x < 2 \\ x^2, & x \ge 2 \end{cases}$

(a) 2

(b) 8

(c) DNE

(d) 4

22 Find $\lim_{x\to -1} f(x)$, where $f(x) = \begin{cases} x^2 + 1, & x < -1 \\ 3x + 1, & x \ge -1 \end{cases}$

(a) DNE

(b) 0

(c) 2

(d) -2

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

(a) 1

(b) 3

(c) -1

(d) DNE

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

(a) DNE

(b) 3

(c) 2

(d) 1

Question 3 : Use the squeeze theorem to find limits

Bridge (English) p. 85 — Exercises 29–32

29 To prove that $\lim_{x\to 0} x^2 sin\left(\frac{1}{x}\right)=0$ using the Squeeze Theorem, we choose functions $f(x)$ and $h(x)$ such that $f(x)\le x^2 sin\left(\frac{1}{x}\right)\le h(x)$. They are

(a) $f(x)=0,\ h(x)=x^2$

(b) $f(x)=-x^2,\ h(x)=x^2$

(c) $f(x)=-x,\ h(x)=x$

(d) $f(x)=-1,\ h(x)=1$

29 Use the Squeeze Theorem to find $\lim_{x\to 0} x^2 sin\left(\frac{1}{x}\right)$

(a) DNE

(b) 1

(c) -1

(d) 0

30 The Squeeze Theorem cannot be used as in Exercise 29 to prove that $\lim_{x\to 0} x^2 sec\left(\frac{1}{x}\right) = 0$ because

(a) the limit of x^2 at 0 is not zero

(b) the function $sec\left(\frac{1}{x}\right)$ is periodic

(c) the function x^2 is not continuous at 0

(d) the function $sec\left(\frac{1}{x}\right)$ is unbounded near 0

31 To prove that $\lim_{x\to 0^+} \left[\sqrt{x}\cos^2\left(\frac{1}{x}\right)\right] = 0$ using the Squeeze Theorem, the appropriate inequality for all $x > 0$ is

(a) $0 \le \sqrt{x}\cos^2\left(\frac{1}{x}\right) \le x$

(b) $-\sqrt{x} \le \sqrt{x}\cos^2\left(\frac{1}{x}\right) \le 0$

(c) $0 \le \sqrt{x}\cos^2\left(\frac{1}{x}\right) \le \sqrt{x}$

(d) $-1 \le \sqrt{x}\cos^2\left(\frac{1}{x}\right) \le 1$

31 Use the Squeeze Theorem to find $\lim_{x\to 0^+} \left[\sqrt{x}\cos^2\left(\frac{1}{x}\right)\right]$

(a) 1

(b) 0

(c) DNE

(d) ∞

32 If $f(x)$ is bounded with $|f(x)| \le M$ for all x , then the inequality used with the Squeeze Theorem to prove that $\lim_{x\to 0} x^2 f(x) = 0$ is

(a) $-M \le x^2 f(x) \le M$

(b) $-x^2 \le x^2 f(x) \le M$

(c) $0 \le x^2 f(x) \le M$

(d) $-Mx^2 \le x^2 f(x) \le Mx^2$

Question 4 : Find limits for polynomials, rational, and trigonometric functions using theorems

Bridge (English) p. 85 — Exercises 7–16

7 Find $\lim_{x\to 2} \frac{x^2-x-2}{x^2-4}$

(a) $\frac{3}{4}$

(b) 1

(c) 0

(d) $-\frac{1}{4}$

8 Find $\lim_{x\to 1} \frac{x^3-1}{x^2+2x-3}$

(a) $\frac{1}{4}$

(b) 1

(c) 3

(d) $\frac{3}{4}$

9 Find $\lim_{x\to 0} \frac{sinx}{tanx}$

(a) DNE

(b) 0

(c) -1

(d) 1

10 Find $\lim_{x\to 0} \frac{tanx}{x}$

(a) 1

(b) 0

(c) DNE

(d) ∞

11 Find $\lim_{x\to 0} \frac{x\,e^{-2x+1}}{x^2+x}$

(a) e

(b) 1

(c) 0

(d) $\frac{1}{e}$

12 Find $\lim_{x\to 0} x^2 \csc^2 x$

(a) 1

(b) ∞

(c) -1

(d) 0

13 Find $\lim_{x\to 0} \frac{\sqrt{x+4}-2}{x}$

(a) $\frac{1}{4}$

(b) 2

(c) 0

(d) $\frac{1}{2}$

14 Find $\lim_{x\to 0} \frac{2x}{3-\sqrt{x+9}}$

(a) 0

(b) -12

(c) -6

(d) 12

15 Find $\lim_{x\to 1} \frac{x-1}{\sqrt{x}-1}$

(a) 2

(b) 1

(c) $\frac{1}{2}$

(d) 0

16 Find $\lim_{x\to 4} \frac{x^3-64}{x-4}$

(a) 64

(b) 12

(c) 48

(d) 16

Question 5 : Study the continuity of a function at a given point

Bridge (English) p. 95 — Exercises 21–28

21 The interval(s) on which $f(x) = \sqrt{x+3}$ is continuous:

(a) $(-\infty, \infty)$

(b) $(-\infty, -3]$

(c) $[-3, \infty)$

(d) $(-3, \infty)$

22 The interval(s) on which $f(x) = \sqrt{x^2-4}$ is continuous:

(a) $(-\infty, -2] \cup [2, \infty)$

(b) $[2, \infty)$

(c) $[-2, 2]$

(d) $(-\infty, -2) \cup (2, \infty)$

23 The interval(s) on which $f(x) = \sqrt[3]{x+2}$ is continuous:

(a) $(-\infty, \infty)$

(b) $(-\infty, -2) \cup (-2, \infty)$

(c) $(-2, \infty)$

(d) $[-2, \infty)$

24 The interval(s) on which $f(x) = (x-1)^{3/2}$ is continuous:

(a) $(1, \infty)$

(b) $[1, \infty)$

(c) $(-\infty, \infty)$

(d) $(-\infty, 1]$

25 The interval(s) on which $f(x) = sin^{-1}(x+2)$ is continuous:

(a) $[-3, -1]$

(b) $[-1, 1]$

(c) $[1, 3]$

(d) $(-3, -1)$

26 The interval(s) on which $f(x) = ln(sinx)$ is continuous:

(a) $(0, \infty)$

(b) $(2k\pi, (2k+1)\pi),\ k \in \mathbb{Z}$

(c) $(k\pi, (k+1)\pi),\ k \in \mathbb{Z}$

(d) $[2k\pi, (2k+1)\pi],\ k \in \mathbb{Z}$

27 The interval(s) on which $f(x) = \frac{\sqrt{x+1}+e^x}{x^2-2}$ is continuous:

(a) $(-1, \sqrt{2}) \cup (\sqrt{2}, \infty)$

(b) $[-1, \sqrt{2}) \cup (\sqrt{2}, \infty)$

(c) $[-1, \infty)$

(d) $(-\infty, -\sqrt{2}) \cup (-\sqrt{2}, \sqrt{2}) \cup (\sqrt{2}, \infty)$

28 The interval(s) on which $f(x) = \frac{ln(x^2-1)}{\sqrt{x^2-2x}}$ is continuous:

(a) $(-\infty, -1) \cup (1, \infty)$

(b) $(-\infty, -1) \cup (2, \infty)$

(c) $(-1, 1) \cup (2, \infty)$

(d) $(-\infty, 0) \cup (2, \infty)$

Question 6 : Use the continuity properties to study the continuity of a function or a composition of functions at a given point

Bridge (English) p. 89 — Example 4.2

1 The value of a that makes $g(x) = \begin{cases} \frac{x^2+2x-3}{x-1}, & x \neq 1 \\ a, & x = 1 \end{cases}$ continuous at $x = 1$ is

(a) 1

(b) 0

(c) 4

(d) 3

2 To extend $f(x) = \frac{x^2+x-2}{x+2}$ to a function that is continuous at $x = -2$, we define $f(-2) =$

(a) -3

(b) 3

(c) 1

(d) 0

3 To extend $f(x) = \frac{x^2-x-6}{x-3}$ to a function that is continuous at $x = 3$, we define $f(3) =$

(a) 5

(b) 6

(c) 0

(d) -5

4 The value(s) of x at which $f(x) = \frac{x-1}{x^2-1}$ has a removable discontinuity:

(a) $x = 1$

(b) $x = 0$

(c) $x = 1,\ x = -1$

(d) $x = -1$

5 Which of the following functions has a removable discontinuity at $x = 0$?

(a) $f(x) = \frac{sinx}{x}$

(b) $f(x) = \frac{1}{x^2}$

(c) $f(x) = \frac{|x|}{x}$

(d) $f(x) = cos\left(\frac{1}{x}\right)$

6 The function $f(x) = \sqrt{4 - x^2}$ is continuous on the interval

(a) $(-2, 2)$

(b) $(-\infty, \infty)$

(c) $[-2, 2]$

(d) $(-\infty, 2]$

7 The function $f(x) = ln(x - 3)$ is continuous on the interval

(a) $(0, \infty)$

(b) $[3, \infty)$

(c) $(-\infty, \infty)$

(d) $(3, \infty)$

Question 7 : Find infinite limits and limits at infinity

Bridge (English) p. 106 — Exercises 9–14

9 Find $\lim_{x\to\infty} \frac{x^2+3x-2}{3x^2+4x-1}$

(a) 3

(b) 2

(c) $\frac{1}{3}$

(d) 0

10 Find $\lim_{x\to\infty} \frac{2x^2-x+1}{4x^2-3x-1}$

(a) 2

(b) -1

(c) $\frac{1}{2}$

(d) 0

11 Find $\lim_{x\to-\infty} \frac{-x}{\sqrt{4+x^2}}$

(a) 0

(b) $\frac{1}{2}$

(c) -1

(d) 1

12 Find $\lim_{x\to\infty} \frac{2x^2-1}{4x^3-5x-1}$

(a) 0

(b) $\frac{1}{2}$

(c) ∞

(d) 2

13 Find $\lim_{x\to\infty} ln\left(\frac{x^2+1}{x-3}\right)$

(a) $-\infty$

(b) 0

(c) ∞

(d) 1

14 Find $\lim_{x\to0^+} ln(xsinx)$

(a) 0

(b) $-\infty$

(c) ∞

(d) 1

Question 8 : Find the average and instantaneous velocity at a given point

Bridge (English) p. 141 — Exercises 19–22

19a The position (in feet) of an object after t seconds is $s(t) = 16t^2 + 10$. The average velocity between $t = 0$ and $t = 2$ is

(a) $32\ ft/s$
(b) $64\ ft/s$
(c) $16\ ft/s$
(d) $48\ ft/s$

19b The position (in feet) of an object after t seconds is $s(t) = 16t^2 + 10$. The average velocity between $t = 1$ and $t = 2$ is

(a) $24\ ft/s$
(b) $64\ ft/s$
(c) $48\ ft/s$
(d) $32\ ft/s$

19c The position (in feet) of an object after t seconds is $s(t) = 16t^2 + 10$. The average velocity between $t = 1.9$ and $t = 2$ is

(a) $62.4\ ft/s$
(b) $60.8\ ft/s$
(c) $64\ ft/s$
(d) $63.84\ ft/s$

19e The position (in feet) of an object after t seconds is $s(t) = 16t^2 + 10$. The instantaneous velocity at $t = 2$ is

(a) $32\ ft/s$
(b) $64\ ft/s$
(c) $62.4\ ft/s$
(d) $74\ ft/s$

20b The position (in feet) of an object after t seconds is $s(t) = 3t^3 + t$. The average velocity between $t = 1$ and $t = 2$ is

(a) $37\ ft/s$
(b) $13\ ft/s$
(c) $26\ ft/s$
(d) $22\ ft/s$

20e The position (in feet) of an object after t seconds is $s(t) = 3t^3 + t$. The instantaneous velocity at $t = 2$ is

(a) $37\ ft/s$
(b) $13\ ft/s$
(c) $22\ ft/s$
(d) $36\ ft/s$

21a The position (in feet) of an object after t seconds is $s(t) = \sqrt{t^2 + 8t}$. The average velocity between $t = 0$ and $t = 2$ is

(a) $2\sqrt{5}\ ft/s$
(b) $\frac{\sqrt{5}}{4}\ ft/s$
(c) $\sqrt{5}\ ft/s$
(d) $\frac{3}{\sqrt{5}}\ ft/s$

21e The position (in feet) of an object after t seconds is $s(t) = \sqrt{t^2 + 8t}$. The instantaneous velocity at $t = 2$ is

(a) $\frac{6}{\sqrt{5}}\ ft/s$
(b) $\sqrt{5}\ ft/s$
(c) $\frac{1}{2\sqrt{5}}\ ft/s$
(d) $\frac{3}{\sqrt{5}}\ ft/s$

22a The position (in feet) of an object after t seconds is $s(t) = 3sin(t - 2)$. The average velocity between $t = 0$ and $t = 2$ is

(a) $0\ ft/s$
(b) $\frac{3}{2}sin2\ ft/s$
(c) $-\frac{3}{2}sin2\ ft/s$
(d) $3sin2\ ft/s$

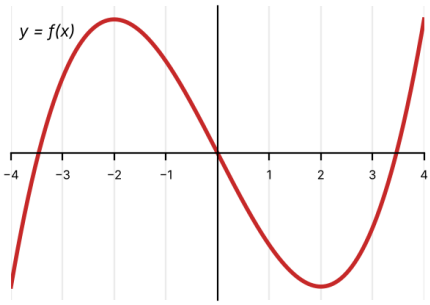
22e The position (in feet) of an object after t seconds is $s(t) = 3sin(t - 2)$. The instantaneous velocity at $t = 2$ is

(a) $-3\ ft/s$
(b) $1\ ft/s$
(c) $0\ ft/s$
(d) $3\ ft/s$

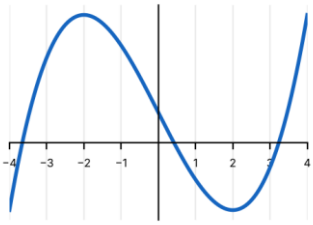
Question 9 : Sketch the graph of a function using that of its derivative

Bridge (English) p. 147 — Example 2.5

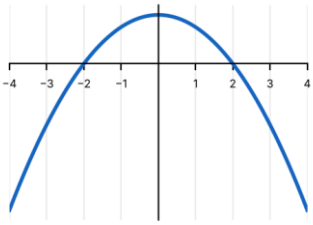
1 **The graph shows $y = f(x)$. Which of the following is the graph of the derivative $y = f'(x)$?**



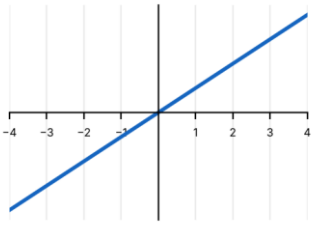
a



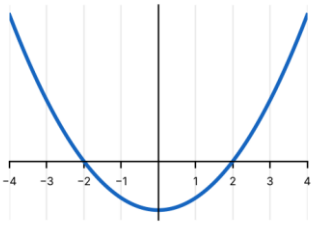
b



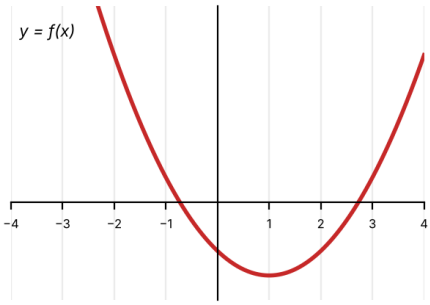
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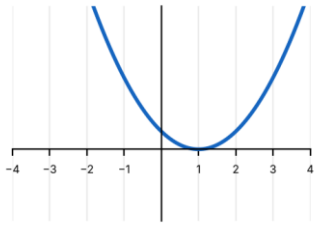
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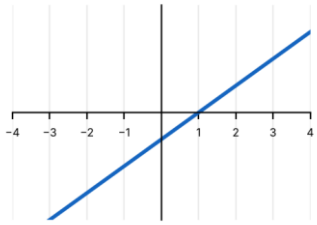
2 **The graph shows $y = f(x)$. Which of the following is the graph of the derivative $y = f'(x)$?**



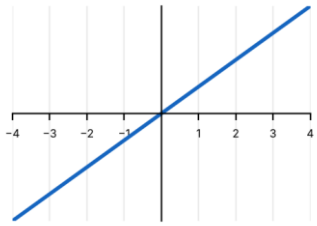
a



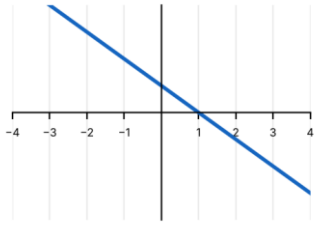
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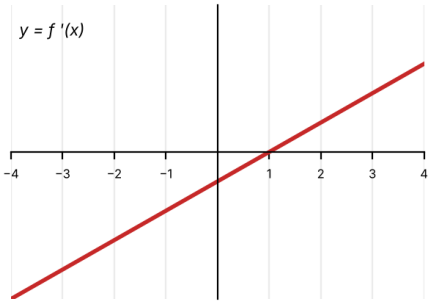
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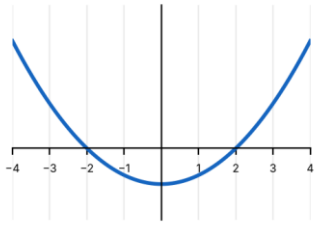
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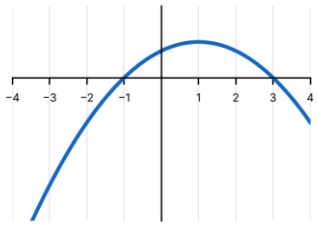
3 **The graph shows the derivative $y = f'(x)$. Which of the following could be the graph of $y = f(x)$?**



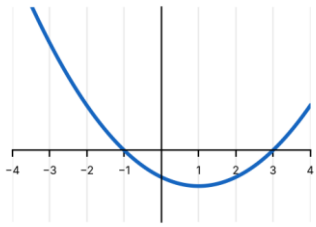
(a)



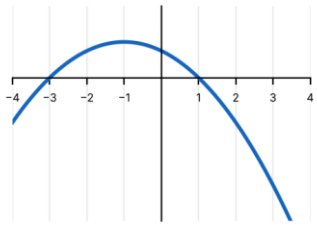
(b)



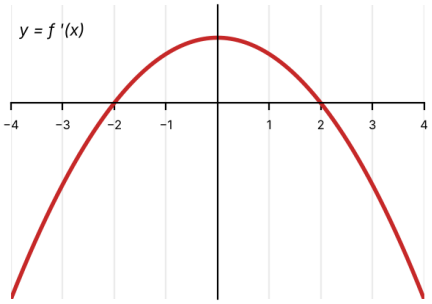
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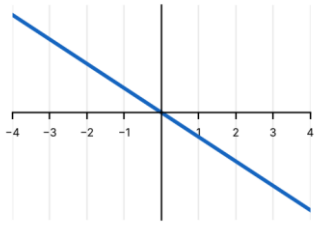
(d)



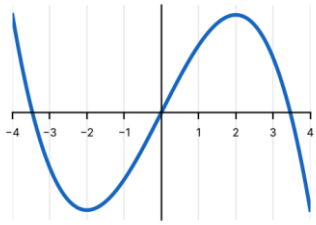
4 **The graph shows the derivative $y = f'(x)$. Which of the following could be the graph of $y = f(x)$?**



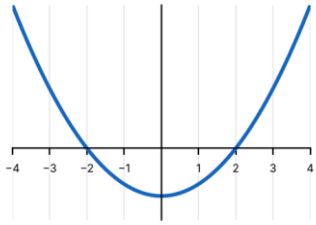
a



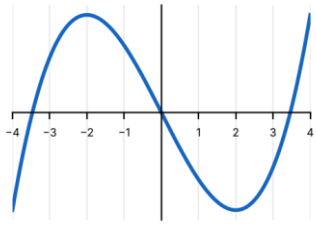
b



c



d



5 If $f'(x) > 0$ for $x < -2$, $f'(x) < 0$ for $-2 < x < 2$ and $f'(x) > 0$ for $x > 2$, then the graph of f is

(a) decreasing, then increasing, then decreasing

(b) always increasing

(c) increasing, then decreasing, then increasing

(d) always decreasing

Question 10 : Find the derivative of a function at a given point

Bridge (English) p. 152 — Exercises 29–30

29a The x-value(s) at which $f(x) = |x| + |x - 2|$ is not differentiable:

(a) $x = 0$

(b) $x = 0,\ x = 2$

(c) $x = 1$

(d) $x = 2$

29b The x-value(s) at which $f(x) = |x^2 - 4x|$ is not differentiable:

(a) $x = 0,\ x = 2,\ x = 4$

(b) $x = 2$

(c) $x = 4$

(d) $x = 0,\ x = 4$

30a The x-value(s) at which $g(x) = e^{-2/x}$ is not differentiable:

(a) $x = 2$

(b) $x = -2$

(c) $x = \pm 2$

(d) $x = 0$

30b The x-value(s) at which $g(x) = e^{-2/(x^3 - x)}$ is not differentiable:

(a) $x = 0$

(b) $x = \pm 1$

(c) $x = 0,\ x = \pm 1$

(d) $x = \pm 2$

Question 11 : Find the derivative of a function using the Power Rule at a given point

Bridge (English) p. 160 — Exercises 7–14

7 If $h(x) = \frac{10}{\sqrt[3]{x}} - 2x + \pi$, then $h'(1) =$

(a) $-\frac{16}{3}$

(b) $\frac{4}{3}$

(c) $-\frac{10}{3}$

(d) $-\frac{16}{3} + \pi$

8 If $h(x) = 12x - x^2 - \frac{3}{\sqrt{x^2}},\ x > 0$, then $h'(1) =$

(a) 7

(b) 11

(c) 13

(d) 10

9 If $f(s) = 2s^{3/2} - 3s^{-1/3}$, then $f'(1) =$

(a) 2

(b) 4

(c) 3

(d) 6

10 If $f(t) = 3t^{\pi} - 2t^{1.3}$, then $f'(1) =$

(a) $\pi - 2.6$

(b) $3\pi - 2.6$

(c) $3\pi - 1.3$

(d) $3\pi + 2.6$

11 If $f(x) = \frac{3x^2 - 3x + 1}{2x}$, then $f'(1) =$

(a) $\frac{1}{2}$

(b) 2

(c) 1

(d) $\frac{3}{2}$

12 If $f(x)=\frac{4x^2-x+3}{\sqrt{x}}$, then $f'(1)=$

(a) 4

(b) 6

(c) 5

(d) 7

13 If $f(x)=x\left(3x^2-\sqrt{x}\right)$, then $f'(1)=$

(a) $\frac{15}{2}$

(b) $\frac{3}{2}$

(c) $\frac{17}{2}$

(d) 8

14 If $f(x)=(x+1)(3x^2-4)$, then $f'(1)=$

(a) 6

(b) 9

(c) 11

(d) 15

Question 12 : Applying the rules of multiplication and division to derivatives

Bridge (English) p. 169 — Exercises 21–24

21a If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=f(x)\,g(x)$ at $x=0$ is

(a) $y=-4x-3$

(b) $y=-2x-3$

(c) $y=x-3$

(d) $y=-2x+3$

21b If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=f(x)\,g(x)$ at $x=1$ is

(a) $y=-6x+4$

(b) $y=-x-1$

(c) $y=7x-2$

(d) $y=7x-9$

22a If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=\frac{f(x)}{g(x)}$ at $x=1$ is

(a) $y=x-3$

(b) $y=-3x+1$

(c) $y=7x-9$

(d) $y=-x-1$

22b If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=\frac{f(x)}{g(x)}$ at $x=0$ is

(a) $y=-\frac{4}{3}x-\frac{1}{3}$

(b) $y=-\frac{4}{9}x-\frac{1}{3}$

(c) $y=-\frac{2}{9}x-\frac{1}{3}$

(d) $y=\frac{4}{9}x-\frac{1}{3}$

23a If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=x^2f(x)$ at $x=1$ is

(a) $y=-4x+2$

(b) $y=-x-1$

(c) $y=3x-5$

(d) $y=-x+1$

23b If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=x^2f(x)$ at $x=0$ is

(a) $y=-x$

(b) $y=0$

(c) $y=-2x$

(d) $y=-1$

24a If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=\frac{x^2}{g(x)}$ at $x=1$ is

(a) $y=4x-3$
(b) $y=2x-1$
(c) $y=-4x+5$
(d) $y=1$

24b If f and g are differentiable functions with $f(0)=-1,\ f(1)=-2,\ f'(0)=-1,\ f'(1)=3,\ g(0)=3,\ g(1)=1,\ g'(0)=-1,\ g'(1)=-2$, then an equation of the tangent line to the graph of $h(x)=\frac{x^2}{g(x)}$ at $x=0$ is

(a) $y=\frac{x}{3}$
(b) $y=-\frac{x}{9}$
(c) $y=0$
(d) $y=\frac{1}{3}$

Question 13 : Apply the chain rule for differentiation

Bridge (English) p. 177 — Exercises 31–36

31 If $h(x)=f\big(g(x)\big)$, where $f(1)=3,\ g(1)=2,\ f'(1)=4,\ f'(2)=3,\ g'(1)=-2,\ g'(3)=5$, then $h'(1)=$

(a) -6
(b) 3
(c) -8
(d) 15

32 If $h(x)=f\big(g(x)\big)$, where $f(2)=1,\ g(2)=3,\ f'(2)=-1,\ f'(3)=-3,\ g'(1)=2,\ g'(2)=4$, then $h'(2)=$

(a) -6
(b) -12
(c) -4
(d) 12

35a If f is a differentiable function, then the derivative of $f(x^2)$ is

(a) $f'(x^2)$

(b) $2x\,f'(x^2)$

(c) $f'(2x)$

(d) $2x\,f'(x)$

35b If f is a differentiable function, then the derivative of $[f(x)]^2$ is

(a) $2f'(x)$

(b) $2f(x)\,f'(x)$

(c) $2f(x)$

(d) $[f'(x)]^2$

35c If f is a differentiable function, then the derivative of $f\big(f(x)\big)$ is

(a) $f'\big(f(x)\big)\,f'(x)$

(b) $f'\big(f'(x)\big)$

(c) $[f'(x)]^2$

(d) $f\big(f'(x)\big)\,f'(x)$

36a If f is a differentiable function, then the derivative of $f\big(\sqrt{x}\big)$ is

(a) $\frac{f'(\sqrt{x})}{2\sqrt{x}}$

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

(c) $f'\big(\sqrt{x}\big)$

(d) $\frac{f'(x)}{2\sqrt{x}}$

36b If f is a differentiable function, then the derivative of $\sqrt{f(x)}$ is

(a) $\frac{f'(x)}{2\sqrt{f(x)}}$

(b) $\frac{1}{2\sqrt{f(x)}}$

(c) $2\sqrt{f(x)}\,f'(x)$

(d) $\frac{f'(x)}{2\sqrt{x}}$

36c If f is a differentiable function, then the derivative of $f\big(x\,f(x)\big)$ is

(a) $f'\big(xf(x)\big)\,f'(x)$

(b) $f'\big(xf(x)\big)\,[f(x)+xf'(x)]$

(c) $f'(x)\,[f(x)+xf'(x)]$

(d) $f'\big(xf(x)\big)\,[1+f'(x)]$

Question 14 : Find the derivative of an inverse function using the Chain Rule

Bridge (English) p. 176 — Exercises 17–22

17 The function $f(x) = x^3 + 4x - 1$ has an inverse g . Find $g'(-1)$

(a) 4

(b) $\frac{1}{7}$

(c) $-\frac{1}{4}$

(d) $\frac{1}{4}$

18 The function $f(x) = x^5 + 4x - 2$ has an inverse g . Find $g'(-2)$

(a) $-\frac{1}{2}$

(b) $\frac{1}{84}$

(c) 4

(d) $\frac{1}{4}$

19 The function $f(x) = x^5 + 3x^3 + x$ has an inverse g . Find $g'(5)$

(a) 15

(b) $\frac{1}{5}$

(c) $\frac{1}{3351}$

(d) $\frac{1}{15}$

20 The function $f(x) = x^3 + 2x + 1$ has an inverse g . Find $g'(-2)$

(a) $\frac{1}{14}$

(b) $\frac{1}{5}$

(c) 5

(d) $-\frac{1}{5}$

21 The function $f(x) = \sqrt{x^3 + 2x + 4}$ has an inverse g . Find $g'(2)$

(a) $\frac{1}{2}$

(b) 4

(c) $\frac{1}{4}$

(d) 2

22 The function $f(x) = \sqrt{x^5 + 4x^3 + 3x + 1}$ has an inverse g . Find $g'(3)$

(a) $\frac{3}{10}$

(b) $\frac{10}{3}$

(c) $\frac{3}{20}$

(d) $\frac{1}{3}$

Question 15 : Find the derivatives of trigonometric functions using differentiation rules

Bridge (English) p. 184 — Exercises 9–18

9 If $f(t) = sin3t\,sec3t$, then $f'(t) =$

(a) $3sec^2 3t$

(b) $3cos3t\,sec3ttan3t$

(c) $sec^2 3t$

(d) $-3csc^2 3t$

10 If $f(t) = \sqrt{cos5t\,sec5t}$, then $f'(t) =$

(a) $-5sin5t\,sec5t$

(b) 5

(c) 0

(d) $\frac{5}{2}$

11 If $f(w) = \frac{1}{sin4w}$, then $f'(w) =$

(a) $-4csc4wcot4w$

(b) $-csc4wcot4w$

(c) $4csc4wcot4w$

(d) $-\frac{1}{4cos4w}$

12 If $f(w) = w^2 sec^2 3w$, then $f'(w) =$

(a) $2wsec^2 3w + 6w^2 sec^2 3wtan3w$

(b) $2wsec^2 3w + 2w^2 sec^2 3wtan3w$

(c) $6wsec^2 3wtan3w$

(d) $2wsec^2 3w + 6w^2 sec3wtan3w$

13 If $f(x) = 2sin2xcos2x$, then $f'(x) =$

(a) $2cos4x$

(b) $4cos2x$

(c) $-4sin4x$

(d) $4cos4x$

14 If $f(x) = 4sin^2 3x + 4cos^2 3x$, then $f'(x) =$

(a) 4

(b) 0

(c) $48sin3xcos3x$

(d) $24sin3xcos3x$

15 If $f(x) = tan\sqrt{x^2+1}$, then $f'(x) =$

(a) $sec^2\sqrt{x^2+1}$

(b) $\frac{x\,sec^2\sqrt{x^2+1}}{\sqrt{x^2+1}}$

(c) $2x\,sec^2\sqrt{x^2+1}$

(d) $\frac{sec^2\sqrt{x^2+1}}{2\sqrt{x^2+1}}$

16 If $f(x) = 4x^2 sinx\,sec3x$, then $f'(x) =$

(a) $8xsinxsec3x + 4x^2 cosxsec3x + 4x^2 sinxsec3xtan3x$

(b) $8xsinxsec3x - 4x^2 cosxsec3x + 12x^2 sinxsec3xtan3x$

(c) $8xsinxsec3x + 4x^2 cosxsec3x + 12x^2 sinxsec3xtan3x$

(d) $8xcosx\,sec3xtan3x$

17 If $f(x) = sin^3\left(cos\sqrt{x^3+2x^2}\right)$, then $f'(x) =$

(a) $3sin^2\left(cos\sqrt{x^3+2x^2}\right)cos\left(cos\sqrt{x^3+2x^2}\right)sin\sqrt{x^3+2x^2}\cdot\frac{3x^2+4x}{2\sqrt{x^3+2x^2}}$

(b) $3sin^2\left(cos\sqrt{x^3+2x^2}\right)\cdot\frac{3x^2+4x}{2\sqrt{x^3+2x^2}}$

(c) $-3sin^2\left(cos\sqrt{x^3+2x^2}\right)cos\left(cos\sqrt{x^3+2x^2}\right)sin\sqrt{x^3+2x^2}$

(d) $-3sin^2\left(cos\sqrt{x^3+2x^2}\right)cos\left(cos\sqrt{x^3+2x^2}\right)sin\sqrt{x^3+2x^2}\cdot\frac{3x^2+4x}{2\sqrt{x^3+2x^2}}$

18 If $f(x) = tan^4(sin^2(x^3 + 2x))$, then $f'(x) =$

(a) $4tan^3(sin^2(x^3 + 2x))sec^2(sin^2(x^3 + 2x))cos^2(x^3 + 2x)(3x^2 + 2)$

(b) $8tan^3(sin^2(x^3 + 2x))sec^2(sin^2(x^3 + 2x))sin(x^3 + 2x)cos(x^3 + 2x)$

(c) $8tan^3(sin^2(x^3 + 2x))sec^2(sin^2(x^3 + 2x))sin(x^3 + 2x)cos(x^3 + 2x)(3x^2 + 2)$

(d) $4tan^3(sin^2(x^3 + 2x))sec^2(sin^2(x^3 + 2x))$

Question 16 : Find the derivatives of exponential functions

Bridge (English) p. 194 — Exercises 29–30

29a The value(s) of x at which the tangent line to the graph of $f(x) = x\,e^{-2x}$ is horizontal:

(a) $x = 2$

(b) $x = \frac{1}{2}$

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

(d) $x = 0$

29b The value(s) of x at which the tangent line to the graph of $f(x) = x\,e^{-3x}$ is horizontal:

(a) $x = 3$

(b) $x = \frac{1}{3}$

(c) $x = -\frac{1}{3}$

(d) $x = 0$

30a The value(s) of x at which the tangent line to the graph of $f(x) = x^2e^{-2x}$ is horizontal:

(a) $x = 1$

(b) $x = 0,\ x = 1$

(c) $x = 0,\ x = 2$

(d) $x = 0,\ x = -1$

30b The value(s) of x at which the tangent line to the graph of $f(x) = x^2e^{-3x}$ is horizontal:

(a) $x = \frac{2}{3}$

(b) $x = 0,\ x = \frac{2}{3}$

(c) $x = 0,\ x = \frac{3}{2}$

(d) $x = 0,\ x = -\frac{2}{3}$

Question 17 : Find the derivatives of natural logarithmic functions

Bridge (English) p. 193 — Exercises 20–22

20a If $f(x)=\frac{\sqrt{lnx}}{x}$, then $f'(x)=$

(a) $\frac{1}{2x\sqrt{lnx}}$

(b) $\frac{1+2lnx}{2x^2\sqrt{lnx}}$

(c) $\frac{1-2lnx}{2x^2\sqrt{lnx}}$

(d) $\frac{1-2lnx}{2x\sqrt{lnx}}$

20b If $g(t)=\frac{ln\sqrt{t}}{t}$, then $g'(t)=$

(a) $\frac{1-lnt}{t^2}$

(b) $\frac{1-lnt}{2t^2}$

(c) $\frac{1+lnt}{2t^2}$

(d) $\frac{1}{2t^2}$

21a If $h(x)=e^x lnx$, then $h'(x)=$

(a) $\frac{e^x}{x}$

(b) $e^x lnx+\frac{e^x}{x}$

(c) $e^x lnx$

(d) $e^x\left(lnx-\frac{1}{x}\right)$

21b If $f(x)=e^{lnx}$, then $f'(x)=$

(a) $\frac{1}{x}$

(b) x

(c) 1

(d) e^x

22a If $h(x)=2^{e^x}$, then $h'(x)=$

(a) $e^x\,2^{e^x-1}$

(b) $2^{e^x}ln2$

(c) $2^{e^x}\,e^x$

(d) $2^{e^x}\,e^x ln2$

22b If $f(x)=\frac{e^x}{2^x}$, then $f'(x)=$

(a) $\frac{(1+ln2)\,e^x}{2^x}$

(b) $\frac{(1-ln2)\,e^x}{2^x}$

(c) $\frac{e^x}{2^x ln2}$

(d) $\frac{e^x}{2^x}$

Question 18 : Find derivatives implicitly

Bridge (English) p. 198 — Example 8.2

1 Use implicit differentiation to find $y'(x)$ for the curve $x^2y^2-2x=4-4y$

(a) $\frac{2-2xy^2}{2x^2y+4}$

(b) $\frac{2-2xy^2}{2x^2y}$

(c) $\frac{2+2xy^2}{2x^2y-4}$

(d) $\frac{2xy^2-2}{2x^2y+4}$

2 The slope of the tangent line to the curve $x^2y^2-2x=4-4y$ at the point $(2,-2)$ is

(a) $\frac{7}{6}$

(b) $\frac{6}{7}$

(c) $-\frac{7}{6}$

(d) -4

3 The slope of the tangent line to the curve $x^2-4y^3=0$ at the point $(2,1)$ is

(a) 3

(b) $\frac{1}{12}$

(c) $\frac{1}{3}$

(d) $-\frac{1}{3}$

4 The slope of the tangent line to the curve $x^2y^2=4x$ at the point $(1,2)$ is

(a) 0

(b) -2

(c) -1

(d) 1

5 The slope of the tangent line to the curve $x^2y^2 = 3y + 1$ at the point $(2, 1)$ is

(a) -1

(b) $-\frac{4}{11}$

(c) $-\frac{4}{5}$

(d) $\frac{4}{5}$

6 If $y = sin^{-1}x$, then $siny = x$. Using implicit differentiation, $y' =$

(a) $\frac{1}{\sqrt{1-x^2}}$

(b) $\frac{-1}{\sqrt{1-x^2}}$

(c) $\frac{1}{1+x^2}$

(d) $\frac{1}{cosx}$

Question 19 : Use implicit differentiation to find derivatives of inverse trigonometric functions

Bridge (English) p. 204 — Exercises 29–32

29a If $f(x) = sin^{-1}(x^3 + 1)$, then $f'(x) =$

(a) $\frac{3x^2}{\sqrt{1-(x^3+1)^2}}$

(b) $\frac{1}{\sqrt{1-(x^3+1)^2}}$

(c) $\frac{3x^2}{1+(x^3+1)^2}$

(d) $\frac{-3x^2}{\sqrt{1-(x^3+1)^2}}$

29b If $f(x) = sin^{-1}(\sqrt{x})$, then $f'(x) =$

(a) $\frac{1}{\sqrt{1-x}}$

(b) $\frac{1}{2\sqrt{1-x}}$

(c) $\frac{1}{2\sqrt{x}\sqrt{1-x}}$

(d) $\frac{1}{2\sqrt{x}(1+x)}$

30a If $f(x) = cos^{-1}(x^2 + x)$, then $f'(x) =$

(a) $\frac{2x+1}{\sqrt{1-(x^2+x)^2}}$

(b) $\frac{-(2x+1)}{\sqrt{1-(x^2+x)^2}}$

(c) $\frac{-1}{\sqrt{1-(x^2+x)^2}}$

(d) $\frac{-(2x+1)}{1+(x^2+x)^2}$

30b If $f(x) = cos^{-1}\left(\frac{2}{x}\right)$, then $f'(x) =$

(a) $\frac{-2}{x^2\sqrt{1-\frac{4}{x^2}}}$

(b) $\frac{2}{x^2\left(1+\frac{4}{x^2}\right)}$

(c) $\frac{-1}{\sqrt{1-\frac{4}{x^2}}}$

(d) $\frac{2}{x^2\sqrt{1-\frac{4}{x^2}}}$

31a If $f(x) = tan^{-1}\left(\sqrt{x}\right)$, then $f'(x) =$

(a) $\frac{1}{1+x}$

(b) $\frac{1}{2\sqrt{x}(1+x)}$

(c) $\frac{1}{2\sqrt{x}(1+x^2)}$

(d) $\frac{1}{2\sqrt{1+x}}$

31b If $f(x) = tan^{-1}\left(\frac{1}{x}\right)$, then $f'(x) =$

(a) $-\frac{1}{x^2}$

(b) $\frac{x^2}{1+x^2}$

(c) $\frac{1}{1+x^2}$

(d) $\frac{-1}{1+x^2}$

32a If $f(x) = \sqrt{2 + tan^{-1}x}$, then $f'(x) =$

(a) $\frac{1+x^2}{2\sqrt{2+tan^{-1}x}}$

(b) $\frac{1}{2\sqrt{2+tan^{-1}x}}$

(c) $\frac{1}{2(1+x^2)\sqrt{2+tan^{-1}x}}$

(d) $\frac{1}{(1+x^2)\sqrt{2+tan^{-1}x}}$

32b If $f(x) = e^{tan^{-1}x}$, then $f'(x) =$

(a) $(1 + x^2)\, e^{tan^{-1}x}$

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

(c) $\frac{e^{tan^{-1}x}}{1+x^2}$

(d) $e^{tan^{-1}x}$

Question 20 : Recall the hypotheses of Rolle's Theorem

Bridge (English) p. 213 — Rolle's Theorem 10.1

1 Which of the following is NOT a hypothesis of Rolle's Theorem for f on $[a, b]$?

(a) the function is continuous on the closed interval

(b) $f'(a) = f'(b) = 0$

(c) $f(a) = f(b)$

(d) the function is differentiable on the open interval

2 Which function satisfies the hypotheses of Rolle's Theorem on the given interval?

(a) $f(x) = \frac{1}{x^2},\ [-1, 1]$

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

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

(d) $f(x) = |x|,\ [-1, 1]$

3 The function $f(x) = x^{2/3}$ on $[-1, 1]$ does not satisfy Rolle's Theorem because

(a) the function satisfies all the hypotheses

(b) $f(-1) \neq f(1)$

(c) the function is not continuous on the interval

(d) the function is not differentiable at x = 0

4 The function $f(x) = x^2 - 4x + 3$ satisfies the hypotheses of Rolle's Theorem on $[1, 3]$. The value of c that satisfies the theorem is

(a) $c = 0$
(b) $c = 3$
(c) $c = 1$
(d) $c = 2$

5 The function $f(x) = sinx$ satisfies the hypotheses of Rolle's Theorem on $[0, \pi]$. The value of c that satisfies the theorem is

(a) $c = \frac{\pi}{2}$
(b) $c = 0$
(c) $c = \pi$
(d) $c = \frac{\pi}{4}$

6 The function $f(x) = x^3 - x$ satisfies the hypotheses of Rolle's Theorem on $[-1, 1]$. The values of c that satisfy the theorem are

(a) $c = \pm\frac{1}{\sqrt{3}}$
(b) $c = \pm\sqrt{3}$
(c) $c = 0$
(d) $c = \pm 1$

Part 2 : Free-Response Questions (21 – 26)

Question 21 : a) Determine the continuity of a function at a given point b) Use the continuity properties to study the continuity of a function or a composition of functions at a given point

Bridge (English) p. 88 — Definition 4.1 , p. 95 — Exercises 29–32

a) Investigating the continuity of a function at a given point (Definition 4.1)

1 **Explain why $f(x) = \frac{x}{x-1}$ is not continuous at $x = 1$, stating which of the three conditions of Definition 4.1 is not satisfied.**

2 **Explain why $f(x) = \frac{x^2-1}{x-1}$ is not continuous at $x = 1$, stating which of the three conditions of Definition 4.1 is not satisfied.**

3 Explain why $f(x) = sin\frac{1}{x}$ is not continuous at $x = 0$, stating which of the three conditions of Definition 4.1 is not satisfied.

4 Explain why $f(x) = \frac{e^{x-1}}{e^{x}-1}$ is not continuous at $x = 0$, stating which of the three conditions of Definition 4.1 is not satisfied.

5 Explain why $f(x) = \begin{cases} x^2, & x < 2 \\ 3, & x = 2 \\ 3x - 2, & x > 2 \end{cases}$ is not continuous at $x = 2$, stating which of the three conditions of Definition 4.1 is not satisfied.

6 Explain why $f(x) = \begin{cases} x^2, & x < 2 \\ 3x - 2, & x > 2 \end{cases}$ is not continuous at $x = 2$, stating which of the three conditions of Definition 4.1 is not satisfied.

b) Using the properties of continuity (Exercises 29–32, p. 95)

29 Suppose that a state's income tax code states that the tax liability on x dirhams of taxable income is given by $T(x) = \begin{cases} 0, & x \leq 0 \\ 0.14x, & 0 < x < 10,000 \\ c + 0.21x, & 10,000 \leq x \end{cases}$. Determine the constant c that makes this function continuous for all x. Give a rationale why such a function should be continuous.

30 **Suppose a tax code indicates that the tax liability is 12% of the first AED 20,000 of taxable earnings and 16% of the rest. Find the values of the constants a and b for the tax function $T(x) = \begin{cases} 0, & x \le 0 \\ a + 0.12x, & 0 < x \le 20,000 \\ b + 0.16(x - 20,000), & x > 20,000 \end{cases}$ such that $T(x)$ is continuous for all x .**

31 **In Example 4.8 (federal tax rate schedule): $T(x) = 0.30x - 5685$ for $67,700 < x \le 141,250$, $T(x) = 0.35x - b$ for $141,250 < x \le 307,050$, and $T(x) = 0.386x - c$ for $x > 307,050$. Find b and c so that the function is continuous.**

32 In Example 4.8, $T(x) = \begin{cases} 0.10x, & 0 < x \le 6000 \\ 0.15x - 300, & 6000 < x \le 27,950 \end{cases}$. Show that $T(x)$ is continuous at $x = 6000$.

Question 22 : Find horizontal, vertical, and slant asymptotes using limits

Bridge (English) p. 106 — Exercises 29–32

29 Find all vertical and slant asymptotes of $y = \frac{x^3}{4-x^2}$

30 **Find all vertical and slant asymptotes of $y = \frac{x^2+1}{x-2}$**

31 **Find all vertical and slant asymptotes of $y = \frac{x^3}{x^2+x-4}$**

32 **Find all vertical and slant asymptotes of $y = \frac{x^4}{x^3+2}$**

Question 23 : Apply the Product Rule on derivatives

Bridge (English) p. 169 — Exercises 17–20

17 **Find an equation of the tangent line to the graph of $f(x) = (x^2 + 2x)(x^4 + x^2 + 1)$ at $x = 0$**

18 Find an equation of the tangent line to the graph of $f(x) = (x^3 + x + 1)(3x^2 + 2x - 1)$ at $x = 1$

19 Find an equation of the tangent line to the graph of $f(x) = \frac{x+1}{x+2}$ at $x = 0$

20 Find an equation of the tangent line to the graph of $f(x) = \frac{x+3}{x^2+1}$ at $x = 1$

Question 24 : Find the derivatives of trigonometric functions using differentiation rules

Bridge (English) p. 184 — Exercises 3–8

3 Find the derivative of $f(t) = tan^3 2t - csc^4 3t$

4 Find the derivative of $f(t) = t^2 + 2cos^2 4t$

5 **Find the derivative of $f(x) = xcos5x^2$**

6 **Find the derivative of $f(x) = x^2sec4x$**

7 **Find the derivative of $f(x) = \frac{sinx^2}{x^2}$**

8 **Find the derivative of $f(x) = \frac{x^2}{csc^4 2x}$**

Question 25 : Solve real-life problems using derivatives of exponential and logarithmic functions

Bridge (English) p. 194 — Exercises 35–38

35 **A bacterial population starts at 200 and triples every day. Find a formula for the population after t days and find the percentage rate of change in the population.**

36 **A bacterial population starts at 500 and doubles every four days. Find a formula for the population after t days and find the percentage rate of change in the population.**

37 **The concentration of a certain chemical after t seconds of an autocatalytic reaction is given by $c(t) = \frac{6}{2e^{-8t}+1}$. Show that $c'(t) > 0$ and use this information to determine that the concentration of the chemical never exceeds 6.**

38 The concentration of a certain chemical after t seconds of an autocatalytic reaction is given by $c(t) = \frac{10}{9e^{-10t}+2}$. Show that $c'(t) > 0$ and use this information to determine that the concentration of the chemical never exceeds 5.

Question 26 : Understand the Mean Value Theorem and use it in applications

Bridge (English) p. 219 — Exercises 1–6

1 Check the hypotheses of Rolle's Theorem and the Mean Value Theorem for $f(x) = x^2 + 1$ on $[-2, 2]$, and find a value of c that makes the conclusion of the appropriate theorem true.

2 **Check the hypotheses of Rolle's Theorem and the Mean Value Theorem for $f(x) = x^2 + 1$ on $[0, 2]$, and find a value of c that makes the conclusion of the appropriate theorem true.**

3 **Check the hypotheses of Rolle's Theorem and the Mean Value Theorem for $f(x) = x^3 + x^2$ on $[0, 1]$, and find a value of c that makes the conclusion of the appropriate theorem true.**

4 **Check the hypotheses of Rolle's Theorem and the Mean Value Theorem for $f(x) = x^3 + x^2$ on $[-1, 1]$, and find a value of c that makes the conclusion of the appropriate theorem true.**

5 **Check the hypotheses of Rolle's Theorem and the Mean Value Theorem for $f(x) = sinx$ on $\left[0, \frac{\pi}{2}\right]$, and find a value of c that makes the conclusion of the appropriate theorem true.**

6 **Check the hypotheses of Rolle's Theorem and the Mean Value Theorem for $f(x) = sinx$ on $[-\pi, 0]$, and find a value of c that makes the conclusion of the appropriate theorem true.**