



Calculus and Vectors, MCV4U-B

Practice Test

Time: 2 hours

Total Marks: 100

Score: ____%

Instructions

- The Practice Test uses the same format, type of questions, marking scheme, and length as the Final Test.
- To get the most out of this Practice Test, allot yourself two uninterrupted hours, and don't use notes or books. You may use a scientific calculator.
- Write your answers in the space provided.
- The test has five (5) parts. An approximate time is given for each part. Look over the test before you begin, and leave some time to review your work at the end.

Part	Category	Marks	Time (min)
Preview			5
A	Multiple Choice	30	15
B	Knowledge and Understanding	16	15
C	Thinking	22	30
D	Communication	16	25
E	Application	16	25
Review			5
Total		100	120

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Part A: Multiple Choice (30 marks) (approximate time: 15 minutes)

(30 marks: 2 marks each)

1. Evaluate the following limit: $\lim_{x \rightarrow -1} \frac{x^2 + 9x - 4}{x^3}$.
- a) 12
 - b) -6
 - c) -12
 - d) 6
2. What is the limit of $f(x) = \frac{x^2 - 2x - 8}{x + 2}$ as x approaches -2?
- a) 0
 - b) $\frac{0}{0}$
 - c) -6
 - d) -16
3. What is the average rate of change between $x = 1$ and $x = 3$ for the function $g(x) = -3(x - 1)^2 + 11$?
- a) -6
 - b) 5
 - c) -2.5
 - d) 0.4
4. For the function $g(x) = 8x^2 - x + 4$, at what tangent point is the instantaneous rate of change equal to -1?
- a) (1, 11)
 - b) (-1, 13)
 - c) (0, 4)
 - d) (2, 34)

5. Which of the following is the derivative of $h(x) = 40^x$?
- a) $h'(x) = 40x^{x-1}$
 - b) $h'(x) = 40^x (\ln 40)$
 - c) $h'(x) = 40^x (\ln 1)$
 - d) $h'(x) = 40^x (\ln x)$
6. Which of the following is the derivative of $f(x) = 7^{2x^2+x}$?
- a) $f'(x) = (7^{2x^2+x})(4x+1)$
 - b) $f'(x) = (2x^2+x)7^{2x^2+x-1}$
 - c) $f'(x) = 7^{2x^2+x} (\ln 7)$
 - d) $f'(x) = \ln 7(4x+1)(7^{2x^2+x})$
7. Which of the following is the derivative of $h(x) = 4x^3 + e^{16x} - 3^{2x-1}$?
- a) $h'(x) = 12x^2 + 16e^{16x} - 2(\ln 3)3^{2x-1}$
 - b) $h'(x) = 12x^2 + 16e^{16x} - (\ln 3)6^{2x-1}$
 - c) $h'(x) = 12x + 16e^x - 6^{2x-1}$
 - d) $h'(x) = 12x + 16e^x - (2)3^{2x-1}$
8. Which of the following is the derivative of $f(x) = \frac{2x^2}{\cos x}$?
- a) $f'(x) = \frac{4x \cos x + 2x^2 \sin x}{\cos^2 x}$
 - b) $f'(x) = \frac{4x \sin x - 2x^2 \cos x}{\cos^2 x}$
 - c) $f'(x) = \frac{4x}{\cos x} - \frac{2x^2}{\cos^2 x}$
 - d) $f'(x) = \frac{4x \cos x - 2x^2 \cos x}{\cos^2 x}$
9. Which of the following tangent points on $g(x) = \frac{12}{x+1}$ has an instantaneous rate of change of -3 ?
- a) (1, 6)
 - b) (-5, -3)
 - c) (3, 3)
 - d) (-4, -4)

10. Which of the following functions is neither even nor odd?
- a) $f(x) = 4x^2 - 3x + 2$
 - b) $g(x) = 3x^3 - 2x$
 - c) $h(x) = 6x^2 + 1$
 - d) $f(x) = 8x^4 - 5$
11. Find the magnitude of the resultant of two vectors \vec{u} and \vec{v} , given $|\vec{u}| = 5$, $|\vec{v}| = 4$ and the angle between the vectors when they are arranged tail to tail is 65° .
- a) 4.9
 - b) 57.9
 - c) 24.1
 - d) 7.6
12. The slope of the vector that is perpendicular to the scalar equation $2x - 6y + 1 = 0$:
- a) $-\frac{1}{6}$
 - b) $+\frac{1}{2}$
 - c) $-\frac{1}{3}$
 - d) -3
13. The dot product of $\vec{a} = (2, 5, 1)$ and $\vec{b} = (-5, 4, 2)$:
- a) 12
 - b) 5
 - c) $(-3, 9, 3)$
 - d) $(-10, 20, 2)$
14. Given vectors $\vec{u} = (2, 4, -3)$ and $\vec{v} = (6, -2, -1)$, $\vec{u} \times \vec{v}$ is
- a) $(-10, -16, -28)$
 - b) $(12, -8, 3)$
 - c) $(8, 2, -4)$
 - d) $(2, -20, 20)$

- 15.** Given two vectors $\vec{u} = (14, -6)$ and $\vec{v} = (-2, 5)$, the projection of \vec{u} on \vec{v} is
- a)** $(12, -1)$
 - b)** $(-28, -30)$
 - c)** $(4, -10)$
 - d)** no solution

Part B: Knowledge and Understanding (16 marks) (approximate time: 15 minutes)

- 16.** Find the equation of the tangent line to $f(x) = 2x^3 - 4x + 7$ at $(2, 15)$. **(4 marks)**

- 17.** Determine the scalar, vector, and parametric equations of the plane that passes through the points $P(1, 0, 4)$, $Q(3, 1, -6)$ and $R(-2, 3, 5)$. **(12 marks)**

Part C: Thinking (22 marks) (approximate time: 30 minutes)

- 18.** For the function $f(x) = \frac{2x^2}{x^2 - 4}$, find the following:
- a)** the x - and y -intercepts **(2 marks)**

b) the horizontal and vertical asymptotes (**2 marks**)

c) the first and second derivatives (**6 marks: 3 marks each**)

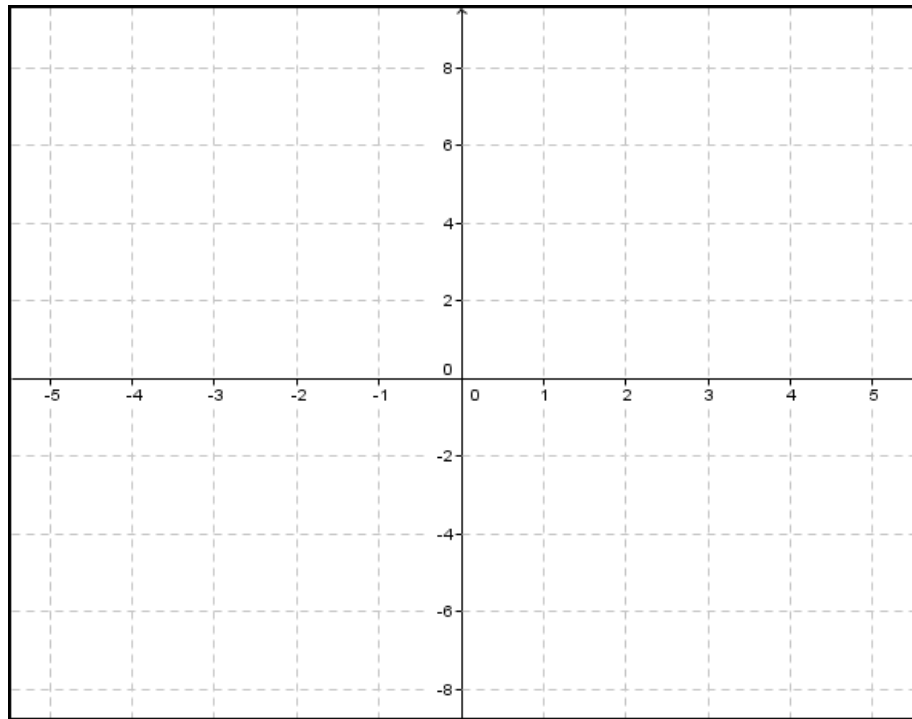
d) any local maximum or minimum points (**2 marks**)

e) the intervals of increasing and decreasing (**3 marks**)

f) any inflection points (**2 marks**)

g) the intervals of concavity (**3 marks**)

h) Now sketch a graph of the function. (2 marks)

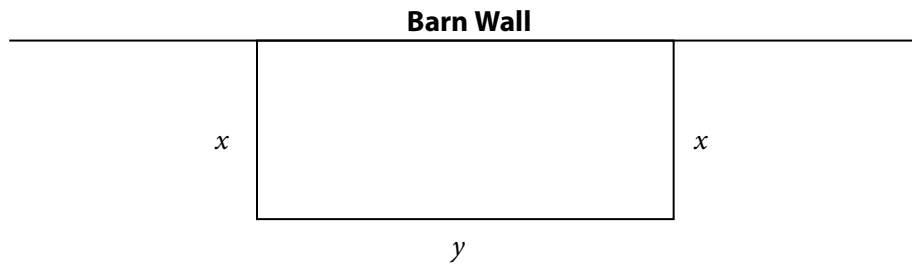


Part D: Communication (16 marks) (approximate time: 25 minutes)

- 19.** Define the terms “concavity” and ‘inflection point,” and describe how you would find the intervals of concavity on a graph given the equation of a function. (8 marks)

- 20.** Your friend is having difficulty answering the following question. List the steps both algebraically and in words to show your friend how to find the solution for the question. **(8 marks: 1 mark for each step)**

A farmer wishes to enclose a rectangular area adjacent to one of his barns with 280 m of fencing. Three sides will be fenced, and the barn will make up the fourth side. Determine the dimensions of the maximum area that can be produced with this amount of fencing.



Part E: Application (16 marks) (approximate time: 25 minutes)

- 21.** The path of a golf ball relative to the ground can be modelled by the function $h(t) = -t^2 + 10t$, where $h(t)$ represents the height of the ball in metres, and t represents time in seconds.
- a)** When does the ball reach its maximum height? (2 marks)
- b)** What is the maximum height of the ball? (2 marks)
- c)** What is the velocity of the ball when it hits the ground? (4 marks)

- 22.** Solve the following system of linear equations and interpret your solution geometrically:
(8 marks)

$$4x - y + 2z = 8 \quad [1]$$

$$x + y - 2z = 7 \quad [2]$$

$$6x - 4y = 10 \quad [3]$$