

Name _____ Section _____

MATH 171 Exam 1B Fall 2022

Section 502/504 P. Yasskin

Multiple Choice and Short Answer:

(Show your work in case there is part credit.)

1-7	/70	9	/5
8	/10	10	/15
		Total	/100

1. (5 points) Find the angle between the vectors $\vec{u} = \langle \sqrt{3}, -3 \rangle$ and $\vec{v} = \langle 1, \sqrt{3} \rangle$.

$\theta =$ _____

2. (10 points) Write $\vec{a} = \langle 3, 7 \rangle$ as the sum of two vectors \vec{p} and \vec{q} where \vec{p} is parallel to $\vec{b} = \langle 10, 4 \rangle$ and \vec{q} is perpendicular to $\vec{b} = \langle 10, 4 \rangle$.

$\vec{a} = \vec{p} + \vec{q}$ where..... $\vec{p} = \langle \text{_____}, \text{_____} \rangle$ and $\vec{q} = \langle \text{_____}, \text{_____} \rangle$

3. (5 points) A line passes through the point $P = (4, -1)$ and is tangent to the direction $\vec{v} = \langle 6, 4 \rangle$. Which of the following points are on the line? (Circle your one answer.)

- a. (10,6)
- b. (7,3)
- c. (-2,-5)
- d. (1,3)

4. (5 points) Find the part of the real line where the function $f(x) = \sqrt{16 - x^2} + \frac{1}{\sqrt{9 - x^2}}$ is continuous.

Continuous on: _____

5. Compute each of the following limits:

a. (5 points) $\lim_{x \rightarrow 3} \frac{x^2 - x - 6}{x^2 - 5x + 6}$ = _____

b. (5 points) $\lim_{h \rightarrow 0} \frac{e^{2+h} - e^2}{h}$ = _____

c. (5 points) $\lim_{x \rightarrow \infty} (\sqrt{x^2 - 3x} - \sqrt{x^2 + 2x})$ = _____

d. (5 points) $\lim_{x \rightarrow 0} \frac{8x^4 + 6x^3}{4x^4 + 2x^3}$ = _____

6. (5 points) Find the horizontal asymptotes of the function $g(x) = \frac{3 \cdot 2^x + 4 \cdot 3^x}{2^x + 2 \cdot 3^x}$.

The horizontal asymptote as $x \rightarrow \infty$ is $y = \underline{\hspace{2cm}}$.

The horizontal asymptote as $x \rightarrow -\infty$ is $y = \underline{\hspace{2cm}}$.

7. Compute each of the following derivatives:

a. (5 points) $f(x) = 4x^3 + \frac{3}{x^4}$ $f'(x) = \underline{\hspace{2cm}}$

b. (5 points) $g(x) = (\sin x + \cos x)^5$ $g'(x) = \underline{\hspace{2cm}}$

c. (5 points) $p(x) = x^\pi + \pi^x$ $p'(x) = \underline{\hspace{2cm}}$

d. (5 points) Find $f'(1)$, if $f(x) = \frac{p(x)q(x)}{r(x)}$, given that

$$p(1) = 7, \quad p'(1) = 6, \quad q(1) = 9, \quad q'(1) = 6, \quad r(1) = 3, \quad r'(1) = 2$$

$f'(1) = \underline{\hspace{2cm}}$

Work Out: (Points indicated. Part credit possible. Show all work.)

8. (10 points) Find the tangent line to the graph of $y = g(x) = \tan x$ at $x = \frac{\pi}{3}$.

$y =$ _____

9. (5 points) Use the limit definition of the derivative to prove $\frac{d}{dx} \cos x = -\sin x$.

10. (15 points) Prove $\lim_{x \rightarrow 3} (2 + 4x) = 14$ by completing the following three steps.

a. Write out the definition.

$$\lim_{x \rightarrow 3} (2 + 4x) = 14 \text{ means:}$$

b. Work backwards to find δ in terms of ε .

c. Complete the proof.