**Name**: _____

**Student ID number**: _____

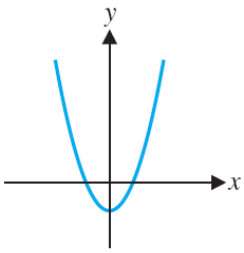
**TA/classroom**:_____

**Guidelines for the test**:

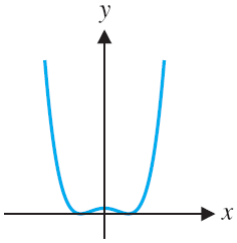
- Put your name or student ID number on every page.
- There are 9 problems
- The exam is closed book; calculators are not allowed.
- There is no partial credit for 選擇, 填充及是非 problems.
- For problem-solving (計算與證明題) problems, please show all work, unless instructed otherwise. Partial credit will be given only for work shown. Print as legibly as possible - correct answers may have points taken off, if they're illegible.
- **Mark the final answer**.

**Calculus** **Student ID number:** _____

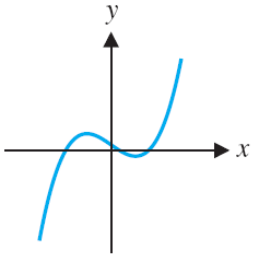
1. (5 pts) Given $f'(x)$, find the graph of $f(x)$?



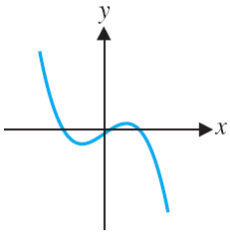

$f'(x)$




(A)




(B)




(C)

2. (15 pts)

   (a) Find the derivative of $f(x) = \ln \sqrt{e^{2x}(x^2+1)^{10}/(2x^3+2)}, \quad x > 0.$

   (b) Find the derivative of $f(x) = e^x \cos(x^3 + x)$.

   (c) Find $\dfrac{d}{dx}(x^2 - \dfrac{1}{x^2})^{10}$

3. (10 pts) Given the curve $x^2 + xy + y^2 = 3$.

   (a) find $\frac{dy}{dx}$ implicitly;

   (b) find the equation of the tangent line at $(1, 1)$?

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4. (20 pts) Compute: (Check whether l'Hospital's rule can be applied before you use it.)

   (a) $\lim_{x\to 9} \dfrac{9-x}{\sqrt{x}-3}$.

   (b) $\lim_{x\to 0^+} x \ln x$

   (c) $\lim_{x\to 0} xe^x$

   (d) $\lim_{x\to 0^+} x^{2x}$

5. (5 pts) Given $f(x) = \dfrac{x\cos x}{(x+1)(x+2)(x+3)\dots(x+100)}$, find $f'(0)$.

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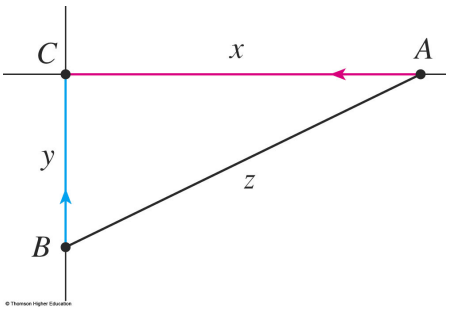
6. (5 pts) Given that $f(x) = \begin{cases} x^2, & x > 0 \\ -x^2, & x \leq 0 \end{cases}$, compute $f'(0)$ by definition (limits).

7. (10 pts) Find the points on the ellipse $4x^2 + y^2 = 4$ that are farthest away from the point $(1, 0)$.

8. (10 pts) Car A is traveling west at 90 **km/h** and car B is traveling north at 100 **km/h**. Both are headed for the intersection of the two roads. At what rate are the cars approaching each other when car A is 60 **m** and car B is 80 **m** from the intersection?



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9. (total 20 points; (a)-(n) no partial credit) Study the function $f(x) = \dfrac{1}{x^2 - 9}$ and answer the following questions.

   (a) (1 pt) Domain of $f$:_____ .

   (b) (1 pt) Horizontal Asymptote:_____ .

   (c) (1 pt) Vertical Asymptote:_____ .

   (d) (1 pt) $f'(x) =$_____ .

   (e) (1 pt) Intervals of increase of $f$:_____ .

   (f) (1 pt) Intervals of decrease of $f$:_____ .

   (g) (1 pt) Local maxima of $f$:_____ .

   (h) (1 pt) Local minima of $f$:_____ .

   (i) (1 pt) $f''(x) =$_____ .

   (j) (1 pt) Intervals of concave up:_____ .

   (k) (1 pt) Intervals of concave down:_____ .

   (l) (1 pt) Inflection point(s) of $f$:_____ .

   (m) (1 pt) x-intercepts of $f$:_____ .

   (n) (1 pt) y-intercepts of $f$:_____ .

   (o) (6 pts) Sketch the graph of $f$ showing all significant features.