VERSION 01

Your name _____

Student ID # _____ Section # and recitation time _____

1. You must use a #2 pencil on the scantron sheet (answer sheet).
2. Check that the cover of your Question Booklet is GREEN and that it has VERSION 01 on the top. On the scantron, Write 01 in the TEST/QUIZ NUMBER boxes and blacken in the appropriate spaces below. Your scantron should be the same color as the cover page of the exam.
3. On the scantron sheet, fill in your YOUR NAME and PURDUE ID NUMBER, and blacken in the appropriate spaces below.
4. On the scantron sheet, fill in the four digit SECTION NUMBER. Enter ZERO as the first digit.
5. Sign the scantron sheet.
6. On the scantron sheet, blacken your choice of the correct answer in the spaces provided for each of the questions 1-25. Do all your work on the exam booklet. Show your work on the exam booklet. Although no partial credit will be given, any disputes about grades or grading will be settled by examining your written work on the exam booklet.
7. There are 25 questions, each worth 8 points. The maximum possible score is 200 points.
8. NO calculator, electronic devices, books or papers are allowed. Use the back of the test pages for scrap paper.
9. After you finish the exam, turn in BOTH the scantron sheets and the exam booklets.
10. If you finish the exam 5 minutes before the ending time, you may leave the room after turning in your scantron sheet and the exam booklet. If you don't finish before 5 minutes before the ending time, you should REMAIN SEATED until your TA comes and collects your scantron sheet and exam booklet. Do not talk to other students until after you have left the exam room.

Exam Policies

1. Students must sit in preassigned seating areas.
2. Students may not open the exam until instructed to do so.
3. No student may leave in the first 20 minutes or in the last 5 minutes of the exam.
4. Students late for more than 20 minutes will not be allowed to take the exam; they will have to contact their lecturer within one day for permission to take a make-up exam.
5. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and exam booklet.
6. Any violation of the above rules may result in a score of zero.

Rules Regarding Academic Dishonesty

1. You are not allowed to seek or obtain any kind of help from anyone to answer questions on the exam. If you have questions, consult only your instructor.
2. You are not allowed to give any kind of help to anyone to answer questions on the exam.
3. Your are not allowed to look at the exam of another student. You may not compare answers with anyone else or consult another person until after you have finished your exam, handed it in to your instructor **and** left the exam room.
4. You may not consult notes, book or calculators. You may not handle cell phones or cameras, or any electronic devices until after you have finished your exam, handed it in to your instructor **and** left the exam room.
5. Anyone who violates these instructions will have committed an act of academic dishonesty. Any violation of these rules and any act of academic dishonesty may result in severe penalties. Additionally, all violators will be reported to the Office of the Dean of Students.

I have read and understand the exam policies and the rules regarding academic dishonesty stated above:

Print your name _____

Student signature _____

1. The domain of $f(x) = \sqrt{(x-1)^2(x-2)^3}$ is

   A. $x \leq 1$ or $x \geq 2$.

   B. $x = 1$ and $x \geq 2$.

   C. $x \leq 2$.

   D. $1 \leq x \leq 2$.

   E. $x \geq 2$.

2. If $f(x) = x^{\sin x}$ then $f'(x) =$

   A. $(\ln x)(\cos x)\ x^{\sin x}$.

   B. $\left(\dfrac{\sin x}{x}\right) x^{\sin x}$.

   C. $\left(\dfrac{\cos x}{x}\right) x^{\sin x}$.

   D. $\left((\ln x)(\cos x) + \dfrac{\sin x}{x}\right) x^{\sin x}$.

   E. $\left((\ln x)(\cos x) - \dfrac{\sin x}{x}\right) x^{\sin x}$.

3. The slope of the tangent line to the graph of $y = \ln(2\sin x)$ at $\left(\frac{5\pi}{6}, 0\right)$ is

   A. 1.

   B. $\sqrt{2}$.

   C. $\sqrt{3}$.

   D. $-\sqrt{2}$.

   E. $-\sqrt{3}$.

4. If $x^2 - xy + y^2 = 3$ and $y = y(x)$ then $\frac{dy}{dx}$ at $(1, 2)$ is

   A. 0.

   B. $\frac{1}{2}$.

   C. 1.

   D. 2.

   E. ∞.

5. If $f(x) = \dfrac{2x-3}{x-2}$ then $f''(x) =$

   A. $\dfrac{-3}{(x-2)^3}$.

   B. $\dfrac{-2}{(x-2)^3}$.

   C. $\dfrac{-1}{(x-2)^3}$.

   D. $\dfrac{1}{(x-2)^3}$.

   E. $\dfrac{2}{(x-2)^3}$.

6. $\lim\limits_{x\to\infty} (x\sqrt{x^2-1} - x^2) =$

   A. $-\infty$.

   B. -1.

   C. $-\dfrac{1}{2}$.

   D. 0.

   E. ∞.

7. A lighthouse is located on an island 4 km from the nearest point P on a straight shoreline, and its light makes four rotations per minute (8π rad/min). How fast is the beam of light moving along the shoreline when it is 3 km from P?

   A. 20π km/min.

   B. 40π km/min.

   C. 50π km/min.

   D. 100π km/min.

   E. 120π km/min.

8. If $f(x) = \cos x$, use a linear approximation to approximate $\cos\left(\frac{\pi}{3} + \frac{1}{10}\right)$.

   A. $\frac{5-\sqrt{3}}{10}$.

   B. $\frac{5+\sqrt{3}}{10}$.

   C. $\frac{2}{5}$.

   D. $\frac{10-\sqrt{3}}{20}$.

   E. $\frac{10+\sqrt{3}}{20}$.

9. A particle moves in a straight line and has acceleration given by $a(t) = 6t + 4$. Its initial displacement is $s(0) = 9$ and the displacement at time $t = 1$ is $s(1) = 6$. Find the velocity of the particle at $t = 2$.

   A. 0.

   B. 4.

   C. 7.

   D. 9.

   E. 14.

10. Express $\tan(\sin^{-1} x)$ as an algebraic function of x.

    A. $\dfrac{1}{\sqrt{1-x^2}}$.

    B. $\dfrac{x}{\sqrt{1-x^2}}$.

    C. $\dfrac{\sqrt{1-x^2}}{x}$.

    D. $\sqrt{1-x^2}$.

    E. $\dfrac{1}{\sqrt{x^2-1}}$.

11. $\lim_{x \to 0} \dfrac{x^2 - x}{|x|} =$

A. 1.

B. -1.

C. 0.

D. -2.

E. Does not exist.

12. Find the values of c for which the function

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

is continuous for all x.

A. $\dfrac{3}{2}$ only.

B. 1 only.

C. 0 only.

D. 0 and $\dfrac{3}{2}$.

E. 0 and 1.

13. Let m and M be the absolute minimum and maximum of $f(x) = x^2\sqrt{5-x}$ on the interval $[-4, 4]$. Then the average of M and m, that is, $(M+m)/2$, is

    A. 32

    B. 24

    C. 15

    D. 11

    E. 4

14. If $f(3) = 3$ and $f'(x) \geq 2$ for $3 \leq x \leq 6$, how small can $f(6)$ possibly be?

    A. 2

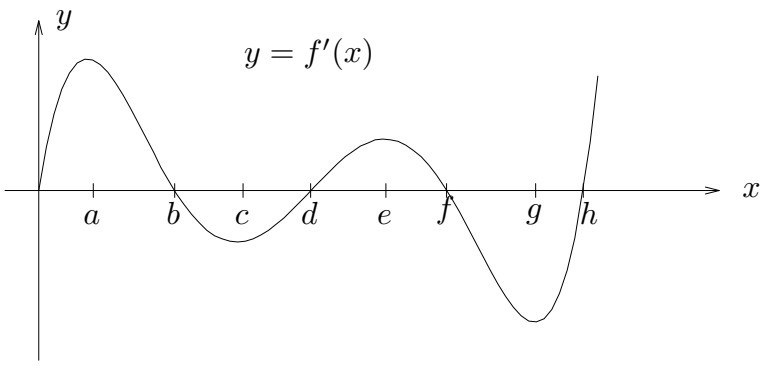
    B. 3

    C. 6

    D. 9

    E. 18

15. The graph of the first deriviative f' of a function f is shown. At what values of x does f have a local maximum?



A. $x = a$ and $x = e$

B. $x = b$ and $x = f$

C. $x = c$ and $x = g$

D. $x = d$ and $x = h$

E. $x = b$ and $x = d$ and $x = f$ and $x = h$

16. For a particular function $y(x)$, $y'(x) = \dfrac{3 - x^2}{(x^2 + 3)^2}$. The graph of y is concave up for

A. $x < -3$ and $0 < x < 3$

B. $-3 < x < 0$ and $x > 3$

C. $x < 0$

D. $x > 0$

E. $x < -3$ and $x > 3$

17. A closed rectangular box (*with* a top) with a square base has a volume of 8 m^3. What is the minimum amount of material required to build such a box?

A. 4 m^2

B. 8 m^2

C. 16 m^2

D. 24 m^2

E. 32 m^2

18. Write as a single integral in the form $\int_a^b f(x)dx$.

$$\int_2^3 f(x)dx - \int_{-1}^3 f(x)dx + \int_{-1}^5 f(x)dx$$

A. $\int_{-1}^2 f(x)dx$

B. $\int_{-1}^3 f(x)dx$

C. $\int_{-1}^5 f(x)dx$

D. $\int_3^5 f(x)dx$

E. $\int_2^5 f(x)dx$

19. $\dfrac{d}{dx}\displaystyle\int_0^{x^2} \frac{1}{1+t^3}dt =$

A. $\dfrac{1}{1+x^6}$

B. $\dfrac{1}{1+x^5}$

C. $\dfrac{2x}{1+x^3}$

D. $\dfrac{2x}{1+x^5}$

E. $\dfrac{2x}{1+x^6}$

20. $\displaystyle\int_{\pi/6}^{\pi/2} \sin(2x)\ dx =$

A. $\dfrac{3}{4}$

B. $\dfrac{1}{2}$

C. $\dfrac{1}{4}$

D. $\dfrac{3}{2}$

E. $\dfrac{2}{3}$

21. One-third of a radioactive substance decays every 5 years. Assuming exponential decay $f(t) = f(0)e^{kt}$, the decay constant $k =$

A. $\frac{1}{3}\ln\frac{1}{5}$.

B. $\frac{1}{5}\ln\frac{3}{5}$.

C. $\frac{1}{5}\ln\frac{2}{3}$.

D. $\frac{1}{3}\ln\frac{2}{5}$.

E. $\frac{1}{3}\ln\frac{2}{3}$.

22. A particle has velocity $v(t) = t^2 - 4t + 3$ and position $s(0) = 0$. Find the total distance traveled during the time interval $0 \leq t \leq 3$.

A. 0

B. $\frac{2}{3}$

C. $\frac{4}{3}$

D. $\frac{8}{3}$

E. $\frac{10}{3}$

23. $\displaystyle\int_0^3 \frac{x}{\sqrt{4-x}}\,dx =$ (Hint: use the substitution $u = 4 - x$.)

A. $\frac{2}{3}$

B. $\frac{4}{3}$

C. $\frac{10}{3}$

D. $-\frac{4}{3}$

E. $-\frac{2}{3}$

24. Find an equation of the hyperbola with foci $(\pm 5, 0)$ and asymptotes $y = \pm 2x$.

A. $\frac{x^2}{5} - \frac{y^2}{20} = 1$

B. $\frac{y^2}{20} - \frac{x^2}{5} = 1$

C. $\frac{x^2}{1} - \frac{y^2}{4} = 1$

D. $\frac{y^2}{4} - \frac{x^2}{1} = 1$

E. $\frac{x^2}{4} - \frac{y^2}{16} = 1$

25. Find an equation of the parabola with focus $(-10, 0)$ and directrix $x = 2$.

A. $y^2 = -24(x + 4)$

B. $y^2 = 24(x - 4)$

C. $x^2 = -24(y + 4)$

D. $x^2 = 24(y - 4)$

E. $y^2 = 24x$