1. **DATE / TIME.**

   Tuesday, March 4, from 6:00 to 8:00 p.m.

   Students with **timetable conflicts** will write the test on the **same day** from 4:00 p.m. to 6:00 p.m.

2. **LOCATIONS.**

   Section L-0101 (Prof. Abou-Ward) writes the test in room CG-150 (Canadiana Gallery)
   Section L-0201 (Prof. Uppal) writes the test in room CG-250 (Canadiana Gallery)
   Section L-5101 (Prof. Recio) writes the test in room WW-111 (Woodsworth College)

   The **4:00 p.m. to 6:00 p.m.** test, for students with **timetable conflicts** from any of the above sections, will be written in room MS-3153 (Medical Sciences Building).

3. **ABOUT THE TEST.**

   Topics to be covered: **textbook chapters 16 (sections 16.5, 16.6, 16.7, 16.8, 16.9)** and **17 (sections 17.1, 17.2, 17.3, 17.4, 17.5).**

   Duration: **2 hours.** Value: **20% of course mark.** Aids allowed: **calculators or any other aids are not allowed.**

4. **MATH AID CENTRES.**

   Sidney Smith Math Aid Centre. Location: Sidney Smith Building, room SS-1071
   - Hours of operation: Posted outside room SS-1071
   - Note: A tutor for MAT 235 is available at this location every Wednesday from 12 noon to 2 p.m. and every Thursday from 4 p.m. to 6 p.m.

   Victoria College Math Aid Centre. Location: Victoria College Building, room 006.
   - Hours of operation: Monday to Thursday, from 12:00 noon to 3:00 p.m.

   St. Michael’s Math Aid Centre. Location: John M. Kelly Library, room 202.
   - Hours of operation: Monday to Thursday, from 12:00 noon to 3:00 p.m.

   Woodsworth College Math Aid Centre. Location: Woodsworth College Building, room 115
   - Hours of operation: Posted outside room WW-115

   University College Math Aid Centre. Location: University College Building, room 048 (basement)
   - Hours of operation: Posted outside room UC-048

   New College Math Aid Centre. Location: New College Building, (basement)
   - Hours of operation: Posted outside MAC room.

5. **SAMPLE QUESTIONS FROM PREVIOUS TEST #3 PAPERS.**

   1. a) (10 marks) Compute the surface area of the part of the cone \(z^2 = 4 (x^2 + y^2)\) that lies between the planes \(z = 2\) and \(z = 4\).

   b) (15 marks) Evaluate \(\int_{-1}^{1} \int_{0}^{\sqrt{1-x^2}} \int_{0}^{\sqrt{1-x^2-y^2}} (x^2 + y^2 + z^2)^2 \, dz \, dy \, dx\).

   2. a) (10 marks) Evaluate the line integral \(\int_{C} z \, ds\), where \(C\) is the curve given by the parametrization \(x = 2 \, t, \ y = t^3 / 3, \ z = 2 \, t^3 / 3, \ 0 \leq t \leq 1\).

   b) (10 marks) Use Green’s Theorem to evaluate the line integral \(\int_{C} (y^2 + \sin (x^2)) \, dx + (x + \cos (y^2)) \, dy\),
   where \(C\) is the triangular curve consisting of the line segments from \((0, 0)\) to \((1, 0)\), from \((1, 0)\) to \((1, 1)\), and from \((1, 1)\) to \((0, 0)\).
3. (10 marks) Let \( \mathbf{F}(x, y, z) = x \mathbf{i} + z \mathbf{j} + ay \mathbf{k} \). Find all the values of the constant \( a \), if any, for which 
\[
\text{div}(\mathbf{F} \times \text{curl} \mathbf{F}) = \text{div} \mathbf{F}.
\]

b) (15 marks) Let \( \mathbf{G}(x, y) = e^{-2y} \sin x \mathbf{i} + (2 e^{2y} + 2 e^{-2y} \cos x) \mathbf{j} \). Find a function \( g(x, y) \) such that 
\[ \nabla g = \mathbf{G}, \]
and use it to evaluate the line integral \( \int_C \mathbf{G} \cdot d\mathbf{r} \), where \( C \) is the arc of the curve \( y = \cos^3 x \),
from \( x = 0 \) to \( x = \pi \).

4. (15 marks) Compute the mass of the solid in the first octant, bounded by the cylinder \( y^2 + z^2 = 1 \), and the planes \( x = 0 \), \( y = 0 \), \( z = 0 \) and \( x+y = 2 \), if the density function is \( \delta(x, y, z) = 2z/(1+y) \).

5. (15 marks) Evaluate \( \iiint_R (x+y) \, dA \), where \( R \) is the region bounded by the curves \( x+y = 2 \), \( x+y = 4 \), \( x^2 - y^2 = 4 \) and \( y = x \). (Hint: Use an appropriate change of variables.)

1. (15 marks) Find the area of the part of the paraboloid \( z = x^2 + y^2 \) that lies inside the cylinder \( x^2 + y^2 = 2 \).

2. (15 marks) A lamina occupies the region \( D = \{ (x, y) \mid -\pi/2 \leq x \leq \pi/2, 0 \leq y \leq \cos x \} \) and has density function \( \rho(x, y) = y \). Find the coordinates of the centre of mass of this lamina.

3. (15 marks) Evaluate \( \iiint_R z \, dV \), where \( R \) is the solid region in the first octant that lies between the sphere \( x^2 + y^2 + z^2 = 1 \) and the cone \( z = \sqrt{x^2 + y^2} \).

4. (15 marks) Use the transformation \( u = x+y, v = x-y \) to evaluate the integral \( \iint_T (x+y)^{-2} \, dA \), where \( T \) is the trapezoidal region with vertices \((1,1), (3,3), (6,0), (2,0)\).

5. (10 marks) Let \( C \) be the curve of intersection of the surfaces \( z = x^2 + y^2 \) and \( x = 2y \). Determine the work done by the force \( \mathbf{F}(x, y, z) = (x-z) \mathbf{i} + (1-z) \mathbf{j} + y \mathbf{k} \) on a particle that moves along the curve \( C \) from \((0,0,0)\) to \((2,1,5)\).

6. (10 marks) Show that the line integral \( \int_C (y^3 \cos(x) \, dx + (\sin(x+y) + x y \cos(x+y)) \, dy) \) is independent of path and evaluate it over any path from \((\pi, 1/2)\) to \((\pi/2, 3)\).

7. (10 marks) Use Green's Theorem to evaluate the line integral \( \int_C (e^x - x y) \, dx + (x^2 + \ln(1+y)) \, dy \), where \( C \) is the triangle with vertices \((0, 0), (1, 2), \) and \((0, 3)\), positively oriented.

8. a) (5 marks) Let \( \mathbf{F}(x, y, z) = (a y^3 - z^2) \mathbf{i} + (b z + x y^2) \mathbf{j} + (c x z + 3 y) \mathbf{k} \), where \( a, b, \) and \( c \) are constants. Compute the curl of \( \mathbf{F} \) and find values of \( a, b, \) and \( c \), if any, for which \( \mathbf{F} \) is conservative.

b) (5 marks) Is there a vector field \( \mathbf{G} \) on \( \mathbb{R}^3 \) such that \( \text{curl} \mathbf{G} = x^3 \mathbf{i} + (z - 2 x^2 y) \mathbf{j} + (2 + z - x^2 z) \mathbf{k} \)?
Justify your answer.