For each question, "**X**" indicates a correct choice.

Answer Sheet - Blue

Question	a	b	c	d	e	Do not write in this column
1				**X**		
2				**X**		
3	**X**					
4			**X**			
5		**X**				
6					**X**	
7				**X**		
8			**X**			

Answer Sheet - Green

Question	a	b	c	d	e	Do not write in this column
1				**X**		
2					**X**	
3			**X**			
4			**X**			
5		**X**				
6				**X**		
7	**X**					
8				**X**		

Answer Sheet - White

Question	a	b	c	d	e	Do not write in this column
1		**X**				
2					**X**	
3			**X**			
4	**X**					
5				**X**		
6			**X**			
7				**X**		
8				**X**		

ANSWER SHEET - YELLOW

For each question, place an "**X**" in the box of your choice.

Question	a	b	c	d	e	Do not write in this column
1				**X**		
2		**X**				
3	**X**					
4					**X**	
5				**X**		
6			**X**			
7			**X**			
8				**X**		

QUESTION SHEET - BLUE

1. If $f(x,y) = e^{\sin x} + x^5 y + \ln(1+y)$, then $\frac{\partial^2 f}{\partial y^2}$ is

   $(a)\ \ 5x^4 \qquad (b)\ \ x^5 + \dfrac{1}{1+y} \qquad (c)\ \ 20x^3 y \qquad (d)\ \ \dfrac{-1}{(1+y)^2} \qquad (e)\ \ e^{\sin x}\cos x + x^5 - \dfrac{1}{1+y^2}.$

2. The radius of curvature $\rho(s)$ of the helix which is parametrised by $\mathbf{r}(t) = (\cos t, \sin t, t)$ is

   $(a)\ \ \dfrac{1}{2} \qquad (b)\ \ \sqrt{2} \qquad (c)\ \ 1/s \qquad (d)\ \ 2 \qquad (e)\ \ s.$

3. The directional derivative of $f(x,y) = x^3 y + 12x^2 - 8y$ at the point $(1,-5)$ in the direction$(3,4)$ is

   $(a)\ \ \dfrac{-1}{5} \qquad (b)\ \ -1 \qquad (c)\ \ 3 \qquad (d)\ \ (9,-7) \qquad (e)\ \ 15.$

4. The value of the triple integral $\iiint_V x^2 - y^2\ dx\,dy\,dz$ where V is the cylinder whose base is the circle of radius 2 centred at the origin in the xy plane and whose height is 1 is given by

   $(a)\ \ -8\pi \qquad (b)\ \ -2\pi \qquad (c)\ \ 0 \qquad (d)\ \ 2\pi \qquad (e)\ \ 8\pi.$

5. If $\mathbf{f} = (xyz, yz^2, y + zx^2)$ then $\nabla \times \mathbf{f}$ is equal to

   $(a)\ \ yz+z^2+x^2 \qquad (b)\ \ (1-2yz, xy-2zx, -xz) \qquad (c)\ \ (1-2yz, -xy+2zx, -xz)$

   $(d)\ \ (-1+2xz, -y+zx, xz) \qquad (e)\ \ yz + z^2 + x^2 + y.$

6. The line integral $\int_C xy\ ds$ where C is the quarter circle in the xy plane extending from (2,0) to (0,2) has value

   $(a)\ \ -1 \qquad (b)\ \ \dfrac{\pi}{2} \qquad (c)\ \ 2 \qquad (d)\ \ \pi \qquad (e)\ \ 4.$

7. The vector field $\mathbf{f} = (2xy - yz + z, x^2 - xz, x - xy)$ is expressible as $\nabla\phi$ where $\phi(x,y,z)$ is

   $(a)\ \ xyz+x^2 \qquad (b)\ \ xyz+xy \qquad (c)\ \ xy+yz+zx \qquad (d)\ \ x^2y-xyz+xz \qquad (e)\ \ x^2y-xz.$

8. The work done in moving a particle against the force field given by $\mathbf{F}(x,y,z) = (2z, -3x, 5y + 2x)$ along the curve described parametrically by $\mathbf{r}(t) = (t, t^2, t^3),\quad 0 \le t \le 2$ is

   $(a)\ \ 3 \qquad (b)\ \ 17 \qquad (c)\ \ 112 \qquad (d)\ \ 200 \qquad (e)\ \ 280.$

QUESTION SHEET - GREEN

1. If $f(x,y) = e^{\sin x} + x^5 y + \ln(1+y)$, then $\frac{\partial^2 f}{\partial y^2}$ is

   $(a)\ \ 5x^4 \qquad (b)\ \ x^5 + \dfrac{1}{1+y} \qquad (c)\ \ 20x^3 y \qquad (d)\ \ \dfrac{-1}{(1+y)^2} \qquad (e)\ \ e^{\sin x}\cos x + x^5 - \dfrac{1}{1+y^2}.$

2. The line integral $\int_C xy\ ds$ where C is the quarter circle in the xy plane extending from (2,0) to (0,2) has value

   $(a)\ \ -1 \qquad (b)\ \ \dfrac{\pi}{2} \qquad (c)\ \ 2 \qquad (d)\ \ \pi \qquad (e)\ \ 4.$

3. The work done in moving a particle against the force field given by $\mathbf{F}(x,y,z) = (2z, -3x, 5y + 2x)$ along the curve described parametrically by $\mathbf{r}(t) = (t, t^2, t^3), \quad 0 \le t \le 2$ is

   $(a)\ \ 3 \qquad (b)\ \ 17 \qquad (c)\ \ 112 \qquad (d)\ \ 200 \qquad (e)\ \ 280.$

4. The value of the triple integral $\iiint_V x^2 - y^2\ dx\,dy\,dz$ where V is the cylinder whose base is the circle of radius 2 centred at the origin in the xy plane and whose height is 1 is given by

   $(a)\ \ -8\pi \qquad (b)\ \ -2\pi \qquad (c)\ \ 0 \qquad (d)\ \ 2\pi \qquad (e)\ \ 8\pi.$

5. If $\mathbf{f} = (xyz, yz^2, y + zx^2)$ then $\nabla \times \mathbf{f}$ is equal to

   $(a)\ \ yz + z^2 + x^2 \qquad (b)\ \ (1 - 2yz, xy - 2zx, -xz) \qquad (c)\ \ (1 - 2yz, -xy + 2zx, -xz)$

   $(d)\ \ (-1 + 2xz, -y + zx, xz) \qquad (e)\ \ yz + z^2 + x^2 + y.$

6. The vector field $\mathbf{f} = (2xy - yz + z, x^2 - xz, x - xy)$ is expressible as $\nabla\phi$ where $\phi(x,y,z)$ is

   $(a)\ \ xyz + x^2 \qquad (b)\ \ xyz + xy \qquad (c)\ \ xy + yz + zx \qquad (d)\ \ x^2 y - xyz + xz \qquad (e)\ \ x^2 y - xz.$

7. The directional derivative of $f(x,y) = x^3 y + 12x^2 - 8y$ at the point $(1, -5)$ in the direction$(3,4)$ is

   $(a)\ \ \dfrac{-1}{5} \qquad (b)\ \ -1 \qquad (c)\ \ 3 \qquad (d)\ \ (9, -7) \qquad (e)\ \ 15.$

8. The radius of curvature $\rho(s)$ of the helix which is parametrised by $\mathbf{r}(t) = (\cos t, \sin t, t)$ is

   $(a)\ \ \dfrac{1}{2} \qquad (b)\ \ \sqrt{2} \qquad (c)\ \ 1/s \qquad (d)\ \ 2 \qquad (e)\ \ s.$

QUESTION SHEET - WHITE

1. If $\mathbf{f} = (xyz, yz^2, y + zx^2)$ then $\nabla \times \mathbf{f}$ is equal to

   (a) $yz+z^2+x^2$ (b) $(1-2yz, xy-2zx, -xz)$ (c) $(1-2yz, -xy+2zx, -xz)$

   (d) $(-1+2xz, -y+zx, xz)$ (e) $yz+z^2+x^2+y$.

2. The line integral $\int_C xy\ ds$ where C is the quarter circle in the xy plane extending from (2,0) to (0,2) has value

   (a) -1 (b) $\dfrac{\pi}{2}$ (c) 2 (d) π (e) 4.

3. The value of the triple integral $\iiint_V x^2 - y^2\ dx\,dy\,dz$ where V is the cylinder whose base is the circle of radius 2 centred at the origin in the xy plane and whose height is 1 is given by

   (a) -8π (b) -2π (c) 0 (d) 2π (e) 8π.

4. The directional derivative of $f(x,y) = x^3y + 12x^2 - 8y$ at the point $(1, -5)$ in the direction$(3, 4)$ is

   (a) $\dfrac{-1}{5}$ (b) -1 (c) 3 (d) $(9, -7)$ (e) 15.

5. If $f(x,y) = e^{\sin x} + x^5y + \ln(1+y)$, then $\frac{\partial^2 f}{\partial y^2}$ is

   (a) $5x^4$ (b) $x^5+\dfrac{1}{1+y}$ (c) $20x^3y$ (d) $\dfrac{-1}{(1+y)^2}$ (e) $e^{\sin x}\cos x+x^5-\dfrac{1}{1+y^2}$.

6. The work done in moving a particle against the force field given by $\mathbf{F}(x,y,z) = (2z, -3x, 5y + 2x)$ along the curve described parametrically by $\mathbf{r}(t) = (t, t^2, t^3),\quad 0 \le t \le 2$ is

   (a) 3 (b) 17 (c) 112 (d) 200 (e) 280.

7. The vector field $\mathbf{f} = (2xy - yz + z, x^2 - xz, x - xy)$ is expressible as $\nabla\phi$ where $\phi(x,y,z)$ is

   (a) $xyz+x^2$ (b) $xyz+xy$ (c) $xy+yz+zx$ (d) $x^2y-xyz+xz$ (e) x^2y-xz.

8. The radius of curvature $\rho(s)$ of the helix which is parametrised by $\mathbf{r}(t) = (\cos t, \sin t, t)$ is

   (a) $\dfrac{1}{2}$ (b) $\sqrt{2}$ (c) $1/s$ (d) 2 (e) s.

QUESTION SHEET - YELLOW

1. The vector field $\mathbf{f} = (2xy - yz + z, x^2 - xz, x - xy)$ is expressible as $\nabla\phi$ where $\phi(x, y, z)$ is

   $(a)\ xyz+x^2$ $(b)\ xyz+xy$ $(c)\ xy+yz+zx$ $(d)\ x^2y-xyz+xz$ $(e)\ x^2y-xz.$

2. If $\mathbf{f} = (xyz, yz^2, y + zx^2)$ then $\nabla \times \mathbf{f}$ is equal to

   $(a)\ yz+z^2+x^2$ $(b)\ (1-2yz, xy-2zx, -xz)$ $(c)\ (1-2yz, -xy+2zx, -xz)$

   $(d)\ (-1 + 2xz, -y + zx, xz)$ $(e)\ yz + z^2 + x^2 + y.$

3. The directional derivative of $f(x, y) = x^3y + 12x^2 - 8y$ at the point $(1, -5)$ in the direction$(3, 4)$ is

   $(a)\ \frac{-1}{5}$ $(b)\ -1$ $(c)\ 3$ $(d)\ (9, -7)$ $(e)\ 15.$

4. The line integral $\int_C xy\ ds$ where C is the quarter circle in the xy plane extending from (2,0) to (0,2) has value

   $(a)\ -1$ $(b)\ \frac{\pi}{2}$ $(c)\ 2$ $(d)\ \pi$ $(e)\ 4.$

5. The radius of curvature $\rho(s)$ of the helix which is parametrised by $\mathbf{r}(t) = (\cos t, \sin t, t)$ is

   $(a)\ \frac{1}{2}$ $(b)\ \sqrt{2}$ $(c)\ 1/s$ $(d)\ 2$ $(e)\ s.$

6. The work done in moving a particle against the force field given by $\mathbf{F}(x, y, z) = (2z, -3x, 5y + 2x)$ along the curve described parametrically by $\mathbf{r}(t) = (t, t^2, t^3),\quad 0 \le t \le 2$ is

   $(a)\ 3$ $(b)\ 17$ $(c)\ 112$ $(d)\ 200$ $(e)\ 280.$

7. The value of the triple integral $\iiint_V x^2 - y^2\ dx\,dy\,dz$ where V is the cylinder whose base is the circle of radius 2 centred at the origin in the xy plane and whose height is 1 is given by

   $(a)\ -8\pi$ $(b)\ -2\pi$ $(c)\ 0$ $(d)\ 2\pi$ $(e)\ 8\pi.$

8. If $f(x, y) = e^{\sin x} + x^5y + \ln(1 + y)$, then $\frac{\partial^2 f}{\partial y^2}$ is

   $(a)\ 5x^4$ $(b)\ x^5+\frac{1}{1+y}$ $(c)\ 20x^3y$ $(d)\ \frac{-1}{(1+y)^2}$ $(e)\ e^{\sin x}\cos x+x^5-\frac{1}{1+y^2}.$