



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: FARIHA FEROZ
ID: 21301185

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
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MAT215: Complex Variables & Laplace Transform
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Section: 12
Name: SADHMAN HOSSAIN
ID: 21301734

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
 - Show that $f(z) = Q1c - a@z^2 + Q1c - b@z - Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = Q1d - a@z\bar{z} - Q1d - b@z + Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{Q1e-k@}{z^2}$ at $z = Q1e - a@ + Q1e - b@i$.
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 - $f(z) = Q2b - a@\cos(Q2b - b@z)$
 - $f(z) = Q2c - a@|z|^2 + Q2c - b@z - Q2c - c@\bar{z}$
 - $f(z) = \frac{Q2d-k@}{z+Q2d-a@-Q2d-b@i}$
 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



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Section: 12

Name: OVISHEK SIKDER OLEEN

ID: 22101557

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1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
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 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
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- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



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Section: 12

Name: SHEIKH HAMIM ISLAM RAJU

ID: 22201994

Submission Date:

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Total Marks: 15

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- | | |
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| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
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BRAC University
Department of Mathematics and Natural Sciences
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Section: 12
Name: OMER HOSSAIN
ID: 22221137

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Summer 2025

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- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
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 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
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Section: 12

Name: ASIF AHMED AKASH

ID: 22221177

Submission Date:

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1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
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 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
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 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
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 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



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Section: 12

Name: SRIJAN KARMAKER

ID: 22299450

Submission Date:

Summer 2025

Total Marks: 15

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- | | |
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| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
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| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
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| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
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| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
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| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
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Section: 12

Name: MOHAMMAD HASIN AL- RAIYAN
ID: 23201223

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
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 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
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 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



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Section: 12

Name: PRANGAN BARUA

ID: 23201370

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- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
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 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: NAFISA TABASSUM
ID: 23201372

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a\partial z - \partial Q1a - b\partial}{\partial Q1a - c\partial z + \partial Q1a - d\partial i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k\partial}{\partial Q1b - a\partial z + \partial Q1b - b\partial}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a\partial z^2 + \partial Q1c - b\partial z - \partial Q1c - c\partial$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a\partial z\bar{z} - \partial Q1d - b\partial z + \partial Q1d - c\partial \bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k\partial}{z^2}$ at $z = \partial Q1e - a\partial + \partial Q1e - b\partial i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a\partial \sinh(\partial Q2a - b\partial z)$
 - $f(z) = \partial Q2b - a\partial \cos(\partial Q2b - b\partial z)$
 - $f(z) = \partial Q2c - a\partial |z|^2 + \partial Q2c - b\partial z - \partial Q2c - c\partial \bar{z}$
 - $f(z) = \frac{\partial Q2d - k\partial}{z + \partial Q2d - a\partial - \partial Q2d - b\partial i}$
 - $f(z) = \partial Q2e - a\partial z^2 e^{\partial Q2e - b\partial z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k\partial \ln((x - \partial Q3a - a\partial)^2 + (y - \partial Q3a - b\partial)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a\partial x^2 y - \partial Q3b - b\partial x^2 - \partial Q3b - a\partial y^3 + \partial Q3b - b\partial y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p\partial e^{-\partial Q3c - a\partial x} \cos(\partial Q3c - a\partial y) - \partial Q3c - q\partial e^{\partial Q3c - b\partial y} \sin(\partial Q3c - b\partial x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k\partial \sin(\partial Q3d - a\partial x) \cosh(\partial Q3d - a\partial y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a\partial x e^{-\partial Q3e - b\partial x} \cos(\partial Q3e - b\partial y) + \partial Q3e - a\partial y e^{-\partial Q3e - b\partial x} \sin(\partial Q3e - b\partial y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: TALHA IBN ANWAR

ID: 23201392

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: IBTIDA HOQUE CHOWDHURY

ID: 23201433

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: TAWHID HASAN
ID: 23201593

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
 - Show that $f(z) = Q1c - a@z^2 + Q1c - b@z - Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = Q1d - a@z\bar{z} - Q1d - b@z + Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{Q1e-k@}{z^2}$ at $z = Q1e - a@ + Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = Q2a - a@\sinh(Q2a - b@z)$
 - $f(z) = Q2b - a@\cos(Q2b - b@z)$
 - $f(z) = Q2c - a@|z|^2 + Q2c - b@z - Q2c - c@\bar{z}$
 - $f(z) = \frac{Q2d-k@}{z+Q2d-a@-Q2d-b@i}$
 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: RAHUL RAHMAN SHIHAB

ID: 23221023

Submission Date:

Summer 2025

Total Marks: 15

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|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: FARZANA SULTANA NASHITA
ID: 23301444

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: JUNAED HASAN
ID: 23321027

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
 - Show that $f(z) = Q1c - a@z^2 + Q1c - b@z - Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = Q1d - a@z\bar{z} - Q1d - b@z + Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{Q1e-k@}{z^2}$ at $z = Q1e - a@ + Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = Q2a - a@\sinh(Q2a - b@z)$
 - $f(z) = Q2b - a@\cos(Q2b - b@z)$
 - $f(z) = Q2c - a@|z|^2 + Q2c - b@z - Q2c - c@\bar{z}$
 - $f(z) = \frac{Q2d-k@}{z+Q2d-a@-Q2d-b@i}$
 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: TOWSIF HASSAN
ID: 23341043

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**
 - a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
 - a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - c) $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
 - a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: SADIA RAHMAN SUPTY

ID: 24101042

Submission Date:

Summer 2025

Total Marks: 15

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|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: RUBAIA TABASSUM SHOMAPTY
ID: 24101079

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
 - a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
 - a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - c) $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
 - a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: MAHBUBA KHANOM MOHUA

ID: 24101101

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: DEWAN SIFAT RAHMAN

ID: 24101128

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: ANHA SADMAN

ID: 24101130

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: OHI AHMED
ID: 24101194

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
 - Show that $f(z) = Q1c - a@z^2 + Q1c - b@z - Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = Q1d - a@z\bar{z} - Q1d - b@z + Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{Q1e-k@}{z^2}$ at $z = Q1e - a@ + Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = Q2a - a@\sinh(Q2a - b@z)$
 - $f(z) = Q2b - a@\cos(Q2b - b@z)$
 - $f(z) = Q2c - a@|z|^2 + Q2c - b@z - Q2c - c@\bar{z}$
 - $f(z) = \frac{Q2d-k@}{z+Q2d-a@-Q2d-b@i}$
 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: ANOY DATTA

ID: 24101395

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: MD. KHALID MAHMUD
ID: 24101490

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
 - Show that $f(z) = Q1c - a@z^2 + Q1c - b@z - Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = Q1d - a@z\bar{z} - Q1d - b@z + Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{Q1e-k@}{z^2}$ at $z = Q1e - a@ + Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = Q2a - a@\sinh(Q2a - b@z)$
 - $f(z) = Q2b - a@\cos(Q2b - b@z)$
 - $f(z) = Q2c - a@|z|^2 + Q2c - b@z - Q2c - c@\bar{z}$
 - $f(z) = \frac{Q2d-k@}{z+Q2d-a@-Q2d-b@i}$
 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: RAISA ZAHIN

ID: 24101491

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: AHRAR HAQUE

ID: 24101515

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: LAMIA RAHMAN

ID: 24101551

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: SAHIRA HUMAIRA HRIDIKA

ID: 24121142

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: MOHAMMAD ZAWAAD MOSTOFA
ID: 24121143

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
 - a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
 - a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - c) $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
 - a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: RUPAM MANDAL
ID: 24121270

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
 - a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
 - a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - c) $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
 - a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: TASNIM REDWAN

ID: 24141015

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: PROMIT DEY SARKER ARJAN
ID: 24141134

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{Q1a-a@z-Q1a-b@}{Q1a-c@z+Q1a-d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{Q1b-k@}{Q1b-a@z+Q1b-b@}$ at $z = z_0$.
 - Show that $f(z) = Q1c - a@z^2 + Q1c - b@z - Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = Q1d - a@z\bar{z} - Q1d - b@z + Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{Q1e-k@}{z^2}$ at $z = Q1e - a@ + Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = Q2a - a@\sinh(Q2a - b@z)$
 - $f(z) = Q2b - a@\cos(Q2b - b@z)$
 - $f(z) = Q2c - a@|z|^2 + Q2c - b@z - Q2c - c@\bar{z}$
 - $f(z) = \frac{Q2d-k@}{z+Q2d-a@-Q2d-b@i}$
 - $f(z) = Q2e - a@z^2 e^{Q2e-b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U}+\mathbf{i}\mathbf{V}$ becomes analytic. **5×10=50**
- Given $V = Q3a - k@\ln((x - Q3a - a@)^2 + (y - Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = Q3b - 3a@x^2y - Q3b - b@x^2 - Q3b - a@y^3 + Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = Q3c - p@e^{-Q3c-a@x} \cos(Q3c - a@y) - Q3c - q@e^{Q3c-b@y} \sin(Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = Q3d - k@\sin(Q3d - a@x) \cosh(Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = Q3e - a@x e^{-Q3e-b@x} \cos(Q3e - b@y) + Q3e - a@y e^{-Q3e-b@x} \sin(Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: AFFAN FAHIM KHAN

ID: 24221202

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: TAHSIN MOHAMMAD MUNIF

ID: 24301136

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: MD. ISHTIAQ MOZUMDER
ID: 24301219

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
 - a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
 - a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - c) $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
 - a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01
Section: 12
Name: SUPORNO GHOSH
ID: 24301509

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
 - a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
 - a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - c) $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
 - a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: SABAH ISLAM SAFIA

ID: 24310009

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

- | | |
|---|----------------|
| 1. Using the definition | 5×5=25 |
| a) Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$. | |
| b) Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$. | |
| c) Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points. | |
| d) Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$. | |
| e) Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$. | |
| 2. Using C-R equatins determine whether the functions are analytic or not. | 5×5=25 |
| a) $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$ | |
| b) $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$ | |
| c) $f(z) = \partial Q2c - a@ z ^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$ | |
| d) $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$ | |
| e) $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$ | |
| 3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. | 5×10=50 |
| a) Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U . | |
| b) Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V . | |
| c) Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U . | |
| d) Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V . | |
| e) Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U . | |



BRAC University
Department of Mathematics and Natural Sciences
MAT215: Complex Variables & Laplace Transform
Assignment-01

Section: 12

Name: URNISHA CHAKMA

ID: 24321046

Submission Date:

Summer 2025

Total Marks: 15

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**
- Find the derivative of $f(z) = \frac{\partial Q1a - a@z - \partial Q1a - b@}{\partial Q1a - c@z + \partial Q1a - d@i}$ at $z = i$.
 - Find the derivative of $f(z) = \frac{\partial Q1b - k@}{\partial Q1b - a@z + \partial Q1b - b@}$ at $z = z_0$.
 - Show that $f(z) = \partial Q1c - a@z^2 + \partial Q1c - b@z - \partial Q1c - c@$ is differentiable at all points.
 - Show that $f(z) = \partial Q1d - a@z\bar{z} - \partial Q1d - b@z + \partial Q1d - c@\bar{z}$ is not differentiable at $z = 0$.
 - Find the derivative of $f(z) = \frac{\partial Q1e - k@}{z^2}$ at $z = \partial Q1e - a@ + \partial Q1e - b@i$.
2. Using C-R equatins determine whether the functions are analytic or not. **5×5=25**
- $f(z) = \partial Q2a - a@ \sinh (\partial Q2a - b@z)$
 - $f(z) = \partial Q2b - a@ \cos (\partial Q2b - b@z)$
 - $f(z) = \partial Q2c - a@|z|^2 + \partial Q2c - b@z - \partial Q2c - c@\bar{z}$
 - $f(z) = \frac{\partial Q2d - k@}{z + \partial Q2d - a@ - \partial Q2d - b@i}$
 - $f(z) = \partial Q2e - a@z^2 e^{\partial Q2e - b@z}$
3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that $\mathbf{U} + \mathbf{i}V$ becomes analytic. **5×10=50**
- Given $V = \partial Q3a - k@ \ln ((x - \partial Q3a - a@)^2 + (y - \partial Q3a - b@)^2)$, show that V is harmonic and find U .
 - Given $U = \partial Q3b - 3a@x^2 y - \partial Q3b - b@x^2 - \partial Q3b - a@y^3 + \partial Q3b - b@y^2$, show that U is harmonic and find V .
 - Given $V = \partial Q3c - p@e^{-\partial Q3c - a@x} \cos (\partial Q3c - a@y) - \partial Q3c - q@e^{\partial Q3c - b@y} \sin (\partial Q3c - b@x)$, show that V is harmonic and find U .
 - Given $U = \partial Q3d - k@ \sin (\partial Q3d - a@x) \cosh (\partial Q3d - a@y)$, show that U is harmonic and find V .
 - Given $V = \partial Q3e - a@x e^{-\partial Q3e - b@x} \cos (\partial Q3e - b@y) + \partial Q3e - a@y e^{-\partial Q3e - b@x} \sin (\partial Q3e - b@y)$, show that V is harmonic and find U .