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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, show that V is harmonic and find U.

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Section: 12

Name: SADHMAN HOSSAIN

ID: 21301734

Submission Date: Summer 2025 Total Marks: 15

Use this page as the cover page of your assignment

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

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   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

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Assignment-01

Section: 12

Name: OVISHEK SIKDER OLEEN

ID: 22101557

Submission Date: Summer 2025 Total Marks: 15

Use this page as the cover page of your assignment

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

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   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

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Section: 12

Name: SHEIKH HAMIM ISLAM RAJU

ID: 22201994

Submission Date: Summer 2025 Total Marks: 15

Use this page as the cover page of your assignment

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

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MAT215: Complex Variables & Laplace Transform

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Section: 12

Name: OMER HOSSAIN

ID: 22221137

Submission Date: Summer 2025 Total Marks: 15

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1. Using the definition **5×5=25**

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

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MAT215: Complex Variables & Laplace Transform

Assignment-01

Section: 12

Name: ASIF AHMED AKASH

ID: 22221177

Submission Date: Summer 2025 Total Marks: 15

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1. Using the definition **5×5=25**

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

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   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

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Assignment-01

Section: 12

Name: SRIJAN KARMAKER

ID: 22299450

Submission Date: Summer 2025 Total Marks: 15

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

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MAT215: Complex Variables & Laplace Transform

Assignment-01

Section: 12

Name: MOHAMMAD HASIN AL- RAIYAN

ID: 23201223

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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

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MAT215: Complex Variables & Laplace Transform

Assignment-01

Section: 12

Name: PRANGAN BARUA

ID: 23201370

Submission Date: Summer 2025 Total Marks: 15

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1. Using the definition **5×5=25**

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

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   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: TAWHID HASAN

ID: 23201593

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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: JUNAED HASAN

ID: 23321027

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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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

Use this page as the cover page of your assignment

1. Using the definition **5×5=25**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: SADIA RAHMAN SUPTY

ID: 24101042

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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, show that V is harmonic and find U.

BRAC University
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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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, show that V is harmonic and find U.

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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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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 $f(z) = \frac{@Q1a-a@z-@Q1a-b@}{@Q1a-c@z+@Q1a-d@i}$ at $z = i$.

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, 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: 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**

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

   b) Find the derivative of $f(z) = \frac{@Q1b-k@}{@Q1b-a@z+@Q1b-b@}$ at $z = z_0$.

   c) Show that $f(z) = @Q1c - a@z^2 + @Q1c - b@z - @Q1c - c@$ is differentiable at all points .

   d) Show that $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ is not differentiable at $z = 0$.

   e) 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**

   a) $f(z) = @Q2a - a@\sinh(@Q2a - b@z)$

   b) $f(z) = @Q2b - a@\cos(@Q2b - b@z)$

   c) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@\bar{z}$

   d) $f(z) = \frac{@Q2d-k@}{z+@Q2d-a@-@Q2d-b@i}$

   e) $f(z) = @Q2e - a@z^2 e^{@Q2e-b@z}$

3. Show that the given function U (or V) is harmonic. Determine the harmonic conjugate V (or U) such that **U+iV** becomes analytic. **5×10=50**

   a) Given $V = @Q3a - k@\ln((x - @Q3a - a@)^2 + (y - @Q3a - b@)^2)$, show that V is harmonic and find U.

   b) 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.

   c) 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.

   d) Given $U = @Q3d-k@\sin(@Q3d - a@x)\cosh(@Q3d - a@y)$, show that U is harmonic and find V.

   e) Given $V = @Q3e-a@xe^{-@Q3e-b@x}\cos(@Q3e - b@y) + @Q3e-a@ye^{-@Q3e-b@x}\sin(@Q3e - b@y)$, show that V is harmonic and find U.