



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

Section: 12

Name: FARIHA FERROZ

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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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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Name: SADHMAN HOSSAIN

ID: 21301734

Submission Date:

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Total Marks: 15

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1. Using the definition **5×5=25**

a) Find the derivative of $f(z) = \frac{a - bz - c}{1 - az + b} \bar{z}$ at $z = i$.

b) Find the derivative of $f(z) = \frac{b - kz}{1 - az + b} \bar{z}$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{e - kz}{z^2}$ at $z = a - b + c - di$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - b \sinh(a - bz)$

b) $f(z) = a - b \cos(a - bz)$

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

d) $f(z) = \frac{e - kz}{z + a - b - ci}$

e) $f(z) = a - bz^2 e^{c - bz}$

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

b) Given $U = a - 3ax^2y - b - ax^2 - c - ay^3 + b - by^2$, show that U is harmonic and find V .

c) Given $V = p e^{-a - bx} \cos(a - by) - q e^{a - bx} \sin(a - by)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - bx) \cosh(a - by)$, show that U is harmonic and find V .

e) Given $V = a - bxe^{-a - bx} \cos(a - by) + c - aye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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Section: 12

Name: OVISHEK SIKDER OLEEN

ID: 22101557

Submission Date:

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Total Marks: 15

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1. Using the definition **5×5=25**

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

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3bx^2y$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - c} \cos(a - cy) - a - qe^{a - c - b} \sin(a - cx)$, show that V is harmonic and find U .

d) Given $U = a - kd \sin(a - cx) \cosh(a - cy)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - c} \cos(a - cy) + a - aye^{-a - c - b} \sin(a - cx)$, show that V is harmonic and find U .



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Name: SHEIKH HAMIM ISLAM RAJU

ID: 22201994

Submission Date:

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Total Marks: 15

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1. Using the definition **5×5=25**

a) Find the derivative of $f(z) = \frac{a - bz - c}{1 - az + b} \bar{z}$ at $z = i$.

b) Find the derivative of $f(z) = \frac{b - kz}{1 - az + b} \bar{z}$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - kz}{z^2}$ at $z = a - b + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - b \sinh(a - bz)$

b) $f(z) = a - b \cos(a - bz)$

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

d) $f(z) = \frac{a - kz}{z + a - b - a - bi}$

e) $f(z) = a - bz^2 e^{a - bz}$

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

b) Given $U = a - b(3x^2y - 3bx^2 - ay^3 + by^2)$, show that U is harmonic and find V .

c) Given $V = a - p e^{-a - bx} \cos(a - by) - q e^{a - bx} \sin(a - by)$, show that V is harmonic and find U .

d) Given $U = a - b \sin(a - bx) \cosh(a - by)$, show that U is harmonic and find V .

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



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Name: OMER HOSSAIN

ID: 22221137

Submission Date:

Summer 2025

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1. Using the definition **5×5=25**

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

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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Name: ASIF AHMED AKASH

ID: 22221177

Submission Date:

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1. Using the definition **5×5=25**

a) Find the derivative of $f(z) = \frac{aQ1a - aQz - aQ1a - bQ}{aQ1a - cQz + aQ1a - dQi}$ at $z = i$.

b) Find the derivative of $f(z) = \frac{aQ1b - kQ}{aQ1b - aQz + aQ1b - bQ}$ at $z = z_0$.

c) Show that $f(z) = aQ1c - aQz^2 + aQ1c - bQz - aQ1c - cQ$ is differentiable at all points.

d) Show that $f(z) = aQ1d - aQz\bar{z} - aQ1d - bQz + aQ1d - cQ\bar{z}$ is not differentiable at $z = 0$.

e) Find the derivative of $f(z) = \frac{aQ1e - kQ}{z^2}$ at $z = aQ1e - aQ + aQ1e - bQi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = aQ2a - aQ \sinh(aQ2a - bQz)$

b) $f(z) = aQ2b - aQ \cos(aQ2b - bQz)$

c) $f(z) = aQ2c - aQ|z|^2 + aQ2c - bQz - aQ2c - cQ\bar{z}$

d) $f(z) = \frac{aQ2d - kQ}{z + aQ2d - aQ - aQ2d - bQi}$

e) $f(z) = aQ2e - aQz^2 e^{aQ2e - bQz}$

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 $V = aQ3a - kQ \ln((x - aQ3a - aQ)^2 + (y - aQ3a - bQ)^2)$, show that V is harmonic and find U .

b) Given $U = aQ3b - 3aQx^2y - aQ3b - bQx^2 - aQ3b - aQy^3 + aQ3b - bQy^2$, show that U is harmonic and find V .

c) Given $V = aQ3c - pQe^{-aQ3c - aQx} \cos(aQ3c - aQy) - aQ3c - qQe^{aQ3c - bQy} \sin(aQ3c - bQx)$, show that V is harmonic and find U .

d) Given $U = aQ3d - kQ \sin(aQ3d - aQx) \cosh(aQ3d - aQy)$, show that U is harmonic and find V .

e) Given $V = aQ3e - aQxe^{-aQ3e - bQx} \cos(aQ3e - bQy) + aQ3e - aQye^{-aQ3e - bQx} \sin(aQ3e - bQy)$, show that V is harmonic and find U .



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Name: SRIJAN KARMAKER

ID: 22299450

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**

a) Find the derivative of $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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: MOHAMMAD HASIN AL- RAIYAN

ID: 23201223

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**

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

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - a xe^{-a - by} \cos(a - by) + a - a ye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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Section: 12

Name: NAFISA TABASSUM

ID: 23201372

Submission Date:

Summer 2025

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1. Using the definition **5×5=25**

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

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

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

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

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c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - xe^{-a - bx} \cos(a - by) + a - ye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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Section: 12

Name: TALHA IBN ANWAR

ID: 23201392

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**

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

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@z$ 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) $f(z) = @Q2c - a@|z|^2 + @Q2c - b@z - @Q2c - c@z$

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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U} + \mathbf{iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - aQz - aQ1a - bQ}{aQ1a - cQz + aQ1a - dQi}$ at $z = i$.

b) Find the derivative of $f(z) = \frac{aQ1b - kQ}{aQ1b - aQz + aQ1b - bQ}$ at $z = z_0$.

c) Show that $f(z) = aQ1c - aQz^2 + aQ1c - bQz - aQ1c - cQ$ is differentiable at all points.

d) Show that $f(z) = aQ1d - aQz\bar{z} - aQ1d - bQz + aQ1d - cQ\bar{z}$ is not differentiable at $z = 0$.

e) Find the derivative of $f(z) = \frac{aQ1e - kQ}{z^2}$ at $z = aQ1e - aQ + aQ1e - bQi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = aQ2a - aQ \sinh(aQ2a - bQz)$

b) $f(z) = aQ2b - aQ \cos(aQ2b - bQz)$

c) $f(z) = aQ2c - aQ|z|^2 + aQ2c - bQz - aQ2c - cQ\bar{z}$

d) $f(z) = \frac{aQ2d - kQ}{z + aQ2d - aQ - aQ2d - bQi}$

e) $f(z) = aQ2e - aQz^2 e^{aQ2e - bQz}$

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 $V = aQ3a - kQ \ln((x - aQ3a - aQ)^2 + (y - aQ3a - bQ)^2)$, show that V is harmonic and find U .

b) Given $U = aQ3b - 3aQx^2y - aQ3b - bQx^2 - aQ3b - aQy^3 + aQ3b - bQy^2$, show that U is harmonic and find V .

c) Given $V = aQ3c - pQe^{-aQ3c - aQx} \cos(aQ3c - aQy) - aQ3c - qQe^{aQ3c - bQy} \sin(aQ3c - bQx)$, show that V is harmonic and find U .

d) Given $U = aQ3d - kQ \sin(aQ3d - aQx) \cosh(aQ3d - aQy)$, show that U is harmonic and find V .

e) Given $V = aQ3e - aQxe^{-aQ3e - bQx} \cos(aQ3e - bQy) + aQ3e - aQye^{-aQ3e - bQx} \sin(aQ3e - bQy)$, 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

a) Find the derivative of $f(z) = \frac{a_1a - a_0z - a_1a - b_0}{a_1a - c_0z + a_1a - d_0i}$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a_1b - k_0}{a_1b - a_0z + a_1b - b_0}$ at $z = z_0$.

c) Show that $f(z) = a_1c - a_0z^2 + a_1c - b_0z - a_1c - c_0$ is differentiable at all points.

d) Show that $f(z) = a_1d - a_0z\bar{z} - a_1d - b_0z + a_1d - c_0\bar{z}$ is not differentiable at $z = 0$.

e) Find the derivative of $f(z) = \frac{a_1e - k_0}{z^2}$ at $z = a_1e - a_0 + a_1e - b_0i$.

2. Using C-R equations determine whether the functions are analytic or not. 5×5=25

a) $f(z) = a_2a - a_0 \sinh(a_2a - b_0z)$

b) $f(z) = a_2b - a_0 \cos(a_2b - b_0z)$

c) $f(z) = a_2c - a_0|z|^2 + a_2c - b_0z - a_2c - c_0\bar{z}$

d) $f(z) = \frac{a_2d - k_0}{z + a_2d - a_0 - a_2d - b_0i}$

e) $f(z) = a_2e - a_0z^2e^{a_2e - b_0z}$

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 $V = a_3a - k_0 \ln((x - a_3a - a_0)^2 + (y - a_3a - b_0)^2)$, show that V is harmonic and find U .

b) Given $U = a_3b - 3a_0x^2y - a_3b - b_0x^2 - a_3b - a_0y^3 + a_3b - b_0y^2$, show that U is harmonic and find V .

c) Given $V = a_3c - p_0e^{-a_3c - a_0x} \cos(a_3c - a_0y) - a_3c - q_0e^{a_3c - b_0y} \sin(a_3c - b_0x)$, show that V is harmonic and find U .

d) Given $U = a_3d - k_0 \sin(a_3d - a_0x) \cosh(a_3d - a_0y)$, show that U is harmonic and find V .

e) Given $V = a_3e - a_0xe^{-a_3e - b_0x} \cos(a_3e - b_0y) + a_3e - a_0ye^{-a_3e - b_0x} \sin(a_3e - b_0y)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.
- b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.
- c) Show that $f(z) = a - az^2 + a - bz - a - c$ is differentiable at all points.
- d) Show that $f(z) = a - az\bar{z} - a - bz + a - c\bar{z}$ is not differentiable at $z = 0$.
- e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

- a) $f(z) = a - a \sinh(a - bz)$
- b) $f(z) = a - a \cos(a - bz)$
- c) $f(z) = a - a|z|^2 + a - bz - a - c\bar{z}$
- d) $f(z) = \frac{a - ke}{z + a - a - a - b}i$
- e) $f(z) = a - az^2 e^{a - bz}$

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 $V = a - k \ln((x - a - a)^2 + (y - a - b)^2)$, show that V is harmonic and find U .
- b) Given $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3bx^2y$, show that U is harmonic and find V .
- c) Given $V = a - pe^{-a - a} \cos(a - ay) - a - qe^{a - a - b} \sin(a - bx)$, show that V is harmonic and find U .
- d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .
- e) Given $V = a - a xe^{-a - a} \cos(a - by) + a - a ye^{-a - a - b} \sin(a - by)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3bx^2y$, show that U is harmonic and find V .

c) Given $V = a - p e^{-a - 3c - a} \cos(a - 3c - a - y) - a - 3c - q e^{a - 3c - b} \sin(a - 3c - b - x)$, show that V is harmonic and find U .

d) Given $U = a - 3d - k \sin(a - 3d - a - x) \cosh(a - 3d - a - y)$, show that U is harmonic and find V .

e) Given $V = a - 3e - a - x e^{-a - 3e - b} \cos(a - 3e - b - y) + a - 3e - a - y e^{-a - 3e - b} \sin(a - 3e - b - y)$, 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e + a - bi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

d) $f(z) = \frac{a - ke}{z + a - a - a - bi}$

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - aye^{-a - bx} \cos(a - by) + a - aye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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 $\mathbf{U+iV}$ 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. 5×5=25

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - a xe^{-a - by} \cos(a - by) + a - a ye^{-a - bx} \sin(a - by)$, 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 $f(z) = \frac{aQ1a - aQz - aQ1a - bQ}{aQ1a - cQz + aQ1a - dQi}$ at $z = i$.

b) Find the derivative of $f(z) = \frac{aQ1b - kQ}{aQ1b - aQz + aQ1b - bQ}$ at $z = z_0$.

c) Show that $f(z) = aQ1c - aQz^2 + aQ1c - bQz - aQ1c - cQ$ is differentiable at all points.

d) Show that $f(z) = aQ1d - aQz\bar{z} - aQ1d - bQz + aQ1d - cQ\bar{z}$ is not differentiable at $z = 0$.

e) Find the derivative of $f(z) = \frac{aQ1e - kQ}{z^2}$ at $z = aQ1e - aQ + aQ1e - bQi$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = aQ2a - aQ \sinh(aQ2a - bQz)$

b) $f(z) = aQ2b - aQ \cos(aQ2b - bQz)$

c) $f(z) = aQ2c - aQ|z|^2 + aQ2c - bQz - aQ2c - cQ\bar{z}$

d) $f(z) = \frac{aQ2d - kQ}{z + aQ2d - aQ - aQ2d - bQi}$

e) $f(z) = aQ2e - aQz^2 e^{aQ2e - bQz}$

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 $V = aQ3a - kQ \ln((x - aQ3a - aQ)^2 + (y - aQ3a - bQ)^2)$, show that V is harmonic and find U .

b) Given $U = aQ3b - 3aQx^2y - aQ3b - bQx^2 - aQ3b - aQy^3 + aQ3b - bQy^2$, show that U is harmonic and find V .

c) Given $V = aQ3c - pQe^{-aQ3c - aQx} \cos(aQ3c - aQy) - aQ3c - qQe^{aQ3c - bQy} \sin(aQ3c - bQx)$, show that V is harmonic and find U .

d) Given $U = aQ3d - kQ \sin(aQ3d - aQx) \cosh(aQ3d - aQy)$, show that U is harmonic and find V .

e) Given $V = aQ3e - aQxe^{-aQ3e - bQx} \cos(aQ3e - bQy) + aQ3e - aQye^{-aQ3e - bQx} \sin(aQ3e - bQy)$, 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ at $z = i$.

b) Find the derivative of $f(z) = \frac{a - kb}{a - bz + a - b}i$ at $z = z_0$.

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

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

e) Find the derivative of $f(z) = \frac{a - ke}{z^2}$ at $z = a - e - a + a - b$.

2. Using C-R equations determine whether the functions are analytic or not. **5×5=25**

a) $f(z) = a - a \sinh(a - bz)$

b) $f(z) = a - a \cos(a - bz)$

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

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

e) $f(z) = a - az^2 e^{a - bz}$

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

b) Given $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - by} \sin(a - bx)$, show that V is harmonic and find U .

d) Given $U = a - k \sin(a - ax) \cosh(a - ay)$, show that U is harmonic and find V .

e) Given $V = a - a xe^{-a - by} \cos(a - by) + a - a ye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .