



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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Section: 12

Name: SADHMAN HOSSAIN

ID: 21301734

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 $f(z) = \frac{a - bz - \bar{a}}{a - cz + \bar{a}}$ at $z = i$.

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

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

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

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

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

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

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

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

b) Given $U = a - 3ax^2y - b - ax^2 - a - by^3 + b - by^2$, 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 $V = a - x e^{-a - bx} \cos(a - by) + a - y e^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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Section: 12

Name: OVISHEK SIKDER OLEEN

ID: 22101557

Submission Date:

Summer 2025

Total Marks: 15

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1. Using the definition **5×5=25**

a) Find the derivative of $f(z) = \frac{a+ib-a-z-bi}{a+ib-cz+id-bi}$ at $z = i$.

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

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

d) Show that $f(z) = a+ib-d-a-z-bi+d-bz+a+ib-cz$ is not differentiable at $z = 0$.

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

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

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

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

c) $f(z) = a+ib-c|z|^2+d+ib-cz-bi-cz$

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

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

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

b) Given $U = a+ib-3a+ix^2y-b+ib-a+iy^3+a+ib-b+iy^2$, show that U is harmonic and find V .

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

d) Given $U = a+ib-d-k \sin(a+ib-dx) \cosh(a+ib-dy)$, show that U is harmonic and find V .

e) Given $V = a+ib-e-a+ixe^{-a+ib-cx} \cos(a+ib-cy)+a+ib-aye^{-a+ib-cx} \sin(a+ib-cy)$, 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**

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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: 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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ 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 $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3bx^2y$, 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:

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 $z = a - e - a + a - b$.

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 $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, 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: 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

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 $V = a - pe^{-a - c} \cos(a - cy) - a - qe^{a - c - b} \sin(a - cx)$, 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 $V = a - exe^{-a - c} \cos(a - cy) + a - ye^{-a - c - b} \sin(a - cx)$, 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 $z = a - e - a + a - b$.

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 $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, 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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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.

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 $V = a - k \ln((x - a)^2 + (y - a)^2)$, 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: 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 $z = i$.

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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 $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, 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: 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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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
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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 .



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Department of Mathematics and Natural Sciences
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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 .



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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 $f(z) = @Q1d - a@z\bar{z} - @Q1d - b@z + @Q1d - c@\bar{z}$ 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
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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 .



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



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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 .



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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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ 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 $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3bx^2y$, 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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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 $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3by^2$, show that U is harmonic and find V .

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - 3c - by} \sin(a - bx)$, show that V is harmonic and find U .

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

e) Given $V = a - aye^{-a - 3e - bx} \cos(a - by) + a - aye^{-a - 3e - bx} \sin(a - by)$, show that V is harmonic and find U .



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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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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
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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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ 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 $V = a - a xe^{-a - bx} \cos(a - by) + a - a ye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .



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Section: 12

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



BRAC University
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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 .



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Department of Mathematics and Natural Sciences
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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 .



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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 $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, 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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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 $z = a - e - a + a - b$.

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 $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, 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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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 .



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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 $z = a - e + a - bi$.

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

c) Given $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - 3c - by} \sin(a - bx)$, show that V is harmonic and find U .

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

e) Given $V = a - aye^{-a - 3e - bx} \cos(a - by) + a - aye^{-a - 3e - bx} \sin(a - by)$, show that V is harmonic and find U .



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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 $U = a - 3ax^2y - a - bx^2 - a - by^3 + a - by^2$, 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: 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 .



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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 $f(z) = \frac{a - az - a - b}{a - cz + a - d}i$ 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 $V = a - pe^{-a - ax} \cos(a - ay) - a - qe^{a - bx} \sin(a - bx)$, 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
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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 $U = a - 3ax^2y - a - 3bx^2 - a - 3by^3 + a - 3bx^2y$, 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
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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
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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
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MAT215: Complex Variables & Laplace Transform
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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 $f(z) = \frac{aQ1a - a@z - @Q1a - b@}{@Q1a - c@z + @Q1a - d@i}$ 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: 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 $V = a - xe^{-a - by} \cos(a - by) + a - ye^{-a - bx} \sin(a - by)$, show that V is harmonic and find U .