CITY UNIVERSITY LONDON

Name:

Classtest Mathematical Methods II, MA3603 (A)

Instructions

Answer all five questions by clearly marking the box of the correct answer. Each question carries 5 marks. Some of the questions may have several correct answers, in which case the 5 marks are distributed equally over the correct answers. A wrong answer will annihilate the marks of a correct answer. Remove any notes from your workplace.

DATE: Monday 26/03/2012 at 14:00

1) Convert the following expression into the Gauss form

$$\frac{3i - \sqrt{2} + 3\sqrt{3} + i\sqrt{6}}{3 + i\sqrt{2}}.$$

☐ This expression can not be converted into Gauss form.

☐ $\sqrt{3}\exp(i\pi/4)$

■ $2\exp(i\pi/6)$

☐ $\sqrt{2}\exp(i\pi/3)$

2) $f(z) = u(x,v)\ + iv(x,y)$ is an analytic function on some domain $D \in \mathbb{C}$. Which of the following statements is correct?

☐ The derivative of $f(z)$ is not analytic.

☐ When $f'(z_0) \neq const$ then $f(z)$ preserves angles at $z_0 \in D$.

■ u and v are harmonic functions.

■ v is the conjugate function of u.

☐ There must be a branch cut in D.

☐ D is conformal.

3) The function

$$f(z) = \left(\frac{1+z}{1-z}\right)^2$$

maps

☐ the exterior of the a unit circle into the lower half plane.

■ the interior of a semi unit circle in the upperhalf plane onto the upper half plane.

☐ the upper half plane into the interior of a unit circle.

☐ the semi-infinite strip centred at 0 of size π into the interior of a unit circle.

4) The Fourier transform of the function

$$u(x) = \frac{1}{2}e^{-|x|}$$

☐ is not defined.

☐ is $1 + e^{-|x|}$.

■ is $1/(1 + x^2)$.

☐ is $1 + x$.

5) $u(x)$ is a piecewise smooth function with exponential growth $\lambda \in \mathbb{R}^+$. We also define the functions

$$v(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$$

$$w(x) = \begin{cases} 0 & \text{for } x < 0 \\ \ln x & \text{for } x \geq 0 \end{cases}$$

$$g(x) = \begin{cases} 0 & \text{for } x < 0 \\ \sin \lambda x & \text{for } x \geq 0 \end{cases}$$

Which of the following statements is correct?

■ $\mathcal{L}(u \star v)(x) = (\mathcal{L}u)(x)(\mathcal{L}v)(x)$ for $x > \lambda$.

☐ $\mathcal{L}(u \star w)(x) = (\mathcal{L}u)(x)(\mathcal{L}w)(x)$ for $x > \lambda$.

☐ $\mathcal{L}(g \star u)(x) = (\mathcal{L}g)(x)(\mathcal{L}u)(x)$ for $x > 0$.

☐ $\mathcal{L}(w \star g)(x) = (\mathcal{L}w)(x)(\mathcal{L}g)(x)$ for $x > \lambda$.

■ $\mathcal{L}(v \star g)(x) = (\mathcal{L}v)(x)(\mathcal{L}g)(x)$ for $x > 0$.

CITY UNIVERSITY LONDON

Name:

Classtest Mathematical Methods II, MA3603 (B)

Instructions

Answer all five questions by clearly marking the box of the correct answer. Each question carries 5 marks. Some of the questions may have several correct answers, in which case the 5 marks are distributed equally over the correct answers. A wrong answer will annihilate the marks of a correct answer. Remove any notes from your workplace.

DATE: Monday 26/03/2012 at 14:00

1) Convert the following expression into the Gauss form

$$\frac{3+\sqrt{2}+i\sqrt{3}-i\sqrt{6}}{\sqrt{3}-i\sqrt{2}}.$$

☐ This expression can not be converted into Gauss form.

■ $2\exp(i\pi/6)$

☐ $\sqrt{3}\exp(i\pi/4)$

☐ $\sqrt{2}\exp(i\pi/3)$

2) $f(z) = u(x,v) + iv(x,y)$ is an analytic function on some domain $D \in \mathbb{C}$. Which of the following statements is correct?

☐ When $f'(z_0) \neq const$ then $f(z)$ preserves angles at $z_0 \in D$.

■ u and v are harmonic functions.

☐ v is not the conjugate function of u.

■ The derivative of $f(z)$ is analytic.

☐ D is conformal.

☐ There must be a branch cut in D.

3) The function

$$f(z) = \frac{1}{2}\left(z + \frac{1}{z}\right)$$

maps

☐ the interior of the a unit circle into the lower half plane.

■ the exterior of a semi unit circle in the upperhalf plane onto the upper half plane.

☐ the upper half plane into the exterior of a unit circle.

☐ the semi-infinite strip centred at 0 of size π into the interior of a unit circle.

4) The Fourier transform of the function

$$u(x) = \frac{1}{2}e^{-|x|}$$

☐ is not defined.

☐ is $1 + e^{-|x|}$.

■ is $1/(1 + x^2)$.

☐ is $1 + x$.

5) $u(x)$ is a piecewise smooth function with exponential growth $\alpha \in \mathbb{R}^+$. We also define the functions

$$v(x) = \begin{cases} 0 & \text{for } x < 0 \\ 2 & \text{for } x \geq 0 \end{cases}$$

$$w(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1/x & \text{for } x \geq 0 \end{cases}$$

$$g(x) = \begin{cases} 0 & \text{for } x < 0 \\ \cos \alpha x & \text{for } x \geq 0 \end{cases}$$

Which of the following statements is correct?

☐ $\mathcal{L}(u \star w)(x) = (\mathcal{L}u)(x)(\mathcal{L}w)(x)$ for $x > \alpha$.

☐ $\mathcal{L}(g \star u)(x) = (\mathcal{L}g)(x)(\mathcal{L}u)(x)$ for $x > 0$.

■ $\mathcal{L}(u \star v)(x) = (\mathcal{L}u)(x)(\mathcal{L}v)(x)$ for $x > \alpha$.

■ $\mathcal{L}(v \star g)(x) = (\mathcal{L}v)(x)(\mathcal{L}g)(x)$ for $x > 0$.

☐ $\mathcal{L}(w \star g)(x) = (\mathcal{L}w)(x)(\mathcal{L}g)(x)$ for $x > \alpha$.

CITY UNIVERSITY LONDON

Name:

Classtest Mathematical Methods II, MA3603 (C)

Instructions

Answer all five questions by clearly marking the box of the correct answer. Each question carries 5 marks. Some of the questions may have several correct answers, in which case the 5 marks are distributed equally over the correct answers. A wrong answer will annihilate the marks of a correct answer. Remove any notes from your workplace.

DATE: Monday 26/03/2012 at 14:00

1) Convert the following expression into the Gauss form

$$\frac{4i + \sqrt{2} + 4\sqrt{3} - i\sqrt{6}}{4 - i\sqrt{2}}.$$

☐ This expression can not be converted into Gauss form.

☐ $\sqrt{3}\exp(i\pi/4)$

☐ $\sqrt{2}\exp(i\pi/3)$

■ $2\exp(i\pi/6)$

2) $f(z) = u(x,v) + iv(x,y)$ is an analytic function on some domain $D \in \mathbb{C}$. Which of the following statements is correct?

☐ The derivative of $f(z)$ is not analytic.

■ When $f'(z_0) \neq 0$ then $f(z)$ preserves angles at $z_0 \in D$.

■ v is the conjugate function of u.

☐ u and v are not harmonic functions.

☐ There must be a branch cut in D.

☐ D is conformal.

3) The function

$$f(z) = \left(\frac{1+z}{1-z}\right)^2$$

maps

☐ the exterior of the a unit circle into the lower half plane.

☐ the upper half plane into the interior of a unit circle.

■ the interior of a semi unit circle in the upperhalf plane onto the upper half plane.

☐ the semi-infinite strip centred at 0 of size π into the interior of a unit circle.

4) The Fourier transform of the function

$$u(x) = \frac{1}{2}e^{-|x|}$$

☐ is not defined.

■ is $1/(1+x^2)$.

☐ is $1+x$.

☐ is $1+e^{-|x|}$.

5) $u(x)$ is a piecewise smooth function with exponential growth $\lambda \in \mathbb{R}^+$. We also define the functions

$$v(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$$

$$w(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1/x & \text{for } x \geq 0 \end{cases}$$

$$g(x) = \begin{cases} 0 & \text{for } x < 0 \\ \sin \lambda x & \text{for } x \geq 0 \end{cases}$$

Which of the following statements is correct?

☐ $\mathcal{L}(u \star w)(x) = (\mathcal{L}u)(x)(\mathcal{L}w)(x)$ for $x > \lambda$.

☐ $\mathcal{L}(g \star u)(x) = (\mathcal{L}g)(x)(\mathcal{L}u)(x)$ for $x > 0$.

■ $\mathcal{L}(u \star v)(x) = (\mathcal{L}u)(x)(\mathcal{L}v)(x)$ for $x > \lambda$.

☐ $\mathcal{L}(w \star g)(x) = (\mathcal{L}w)(x)(\mathcal{L}g)(x)$ for $x > \lambda$.

■ $\mathcal{L}(v \star g)(x) = (\mathcal{L}v)(x)(\mathcal{L}g)(x)$ for $x > 0$.

CITY UNIVERSITY LONDON

Name:

Classtest Mathematical Methods II, MA3603 (D)

Instructions

Answer all five questions by clearly marking the box of the correct answer. Each question carries 5 marks. Some of the questions may have several correct answers, in which case the 5 marks are distributed equally over the correct answers. A wrong answer will annihilate the marks of a correct answer. Remove any notes from your workplace.

DATE: Monday 26/03/2012 at 14:00

1) Convert the following expression into the Gauss form

$$\frac{2i + \sqrt{2} + 2\sqrt{3} - i\sqrt{6}}{2 - i\sqrt{2}}.$$

☐ This expression can not be converted into Gauss form.

☐ $\sqrt{3}\exp(i\pi/4)$

☐ $\sqrt{2}\exp(i\pi/3)$

■ $2\exp(i\pi/6)$

2) $f(z) = u(x,v) + iv(x,y)$ is an analytic function on some domain $D \in \mathbb{C}$. Which of the following statements is correct?

■ When $f'(z_0) \neq 0$ then $f(z)$ preserves angles at $z_0 \in D$.

☐ u and v are not harmonic functions.

☐ v is not the conjugate function of u.

■ The derivative of $f(z)$ is analytic.

☐ D is conformal.

☐ There must be a branch cut in D.

3) The function

$$f(z) = \frac{1}{2}\left(z + \frac{1}{z}\right)$$

maps

☐ the interior of the a unit circle into the lower half plane.

☐ the upper half plane into the exterior of a unit circle.

■ the exterior of a semi unit circle in the upperhalf plane onto the upper half plane.

☐ the semi-infinite strip centred at 0 of size π into the interior of a unit circle.

4) The Fourier transform of the function

$$u(x) = \frac{1}{2}e^{-|x|}$$

☐ is not defined.

☐ is $1 + e^{-|x|}$.

☐ is $1 + x$.

■ is $1/(1 + x^2)$.

5) $u(x)$ is a piecewise smooth function with exponential growth $\alpha \in \mathbb{R}^+$. We also define the functions

$$v(x) = \begin{cases} 0 & \text{for } x < 0 \\ 1 & \text{for } x \geq 0 \end{cases}$$

$$w(x) = \begin{cases} 0 & \text{for } x < 0 \\ 2/x & \text{for } x \geq 0 \end{cases}$$

$$g(x) = \begin{cases} 0 & \text{for } x < 0 \\ \sin \alpha x & \text{for } x \geq 0 \end{cases}$$

Which of the following statements is correct?

■ $\mathcal{L}(u \star v)(x) = (\mathcal{L}u)(x)(\mathcal{L}v)(x)$ for $x > \alpha$.

☐ $\mathcal{L}(u \star w)(x) = (\mathcal{L}u)(x)(\mathcal{L}w)(x)$ for $x > \alpha$.

☐ $\mathcal{L}(g \star u)(x) = (\mathcal{L}g)(x)(\mathcal{L}u)(x)$ for $x > 0$.

☐ $\mathcal{L}(w \star g)(x) = (\mathcal{L}w)(x)(\mathcal{L}g)(x)$ for $x > \alpha$.

■ $\mathcal{L}(v \star g)(x) = (\mathcal{L}v)(x)(\mathcal{L}g)(x)$ for $x > 0$.