Unit 4 - Week 3: Special Functions

Assignment 3

1) A function $y(x)$ satisfies the following: **1 point**

$y(x) = -3$ for $-\infty \leq -1$
$y(x) = 2$ for $-1 < x \leq 1$
$y(x) = -1$ for $1 < x < \infty$
This function is equal to

- $3h(x+1) - 2h(x-1)$
- $-3h(x+1) + 2h(x-1) - 2$
- $-3 + 5h(x+1) - 3h(x-1)$
- None of the above

Accepted Answers:
$-3 + 5h(x+1) - 3h(x-1)$

2) A function $y(x) =$ satisfies the following: **1 point**

$y(x) = 2$ for $-\infty < x \leq -3$
$y(x) = 1$ for $-3 < x \leq 0$
$y(x) = -1$ for $0 < x < 1$
$y(x) = 0$ for $1 < x < \infty$
The derivative of this function is equal to

- $\delta(x+3) + \delta(x) + \delta(1)$
- $3\delta(x+3) - 2\delta(x) - \delta(1)$
- $2\delta(x+3) + \delta(x) - \delta(1)$
- None of the above

Accepted Answers:
None of the above

3) The ratio of $\Gamma(7/2)$ to $\Gamma(1/2)$ is **1 point**

- 15/8
- 3/4
- 105/16
- None of the above

Accepted Answers:
15/8

4) The value of the integral $\int_0^\infty x^3 e^{-4x^2} dx$ is **1 point**

- $\sqrt{\pi/2}$
- $\sqrt{\pi/4}$
- 1/16
- None of the above

Accepted Answers:
None of the above

5) The correct statement about error function, erf(*x*), below is **1 point**

- erf(*x*) > 0 for all x $\geq$ 0
- erf(*x*) is an increasing function of *x* for $0 < x < \infty$.
- erf(*x*) is not a continuous function of *x* for $0 < x < \infty$
- None of the above

Accepted Answers:
erf(x) is an increasing function of x for $0 < x < \infty$*.*

6) The ranges of values of the spherical polar coordinates r, θ, ϕ are **1 point**

- $-\infty < r < \infty, 0 \leq \theta < \pi, 0 \leq \phi < 2\pi$
- $0 \leq r < \infty, 0 \leq \theta < \pi, 0 \leq \phi < 2\pi$
- $-\infty < r < \infty, 0 \leq \theta < 2\pi, 0 \leq \phi < 2\pi$
- None of the above

Accepted Answers:
$0 \leq r < \infty, 0 \leq \theta < \pi, 0 \leq \phi < 2\pi$

7) The ranges of values of the cylindrical polar coordinates ρ, θ, z are **1 point**

- $-\infty < \rho < \infty, 0 \leq \theta < \pi, -\infty < z < \infty$
- $0 \leq \rho < \infty, 0 \leq \theta < 2\pi, 0 \leq z < \infty$
- $0 \leq \rho < \infty, 0 \leq \theta < 2\pi, 0 \leq z < \infty$

$0 \leq \rho < \infty, 0 \leq \theta < 2\pi, -\infty < z < \infty$

None of the above

Accepted Answers:
$0 \leq \rho < \infty, 0 \leq \theta < 2\pi, -\infty < z < \infty$

8) The partial derivative of the spherical polar coordinate ϕ with respect to the cartesian coordinate x, denoted by $\left(\frac{\partial \phi}{\partial x}\right)_{y,z}$ is equal to *1 point*

$-\frac{y}{x^2+y^2}$

$\frac{-1}{y}$

$-\frac{x}{r^2}$

None of the above

Accepted Answers:
$-\frac{y}{x^2+y^2}$

9) According to kinetic theory of gases, the probability that the absolute value of the x-component of the velocity, $|v_x| < \sqrt{2k_BT/m}$ is *1 point*

Erf(1)

Erf($\sqrt{2}$)

Erf(2)

None of the above

Accepted Answers:
Erf(1)

10)A certain probability distribution in spherical polar coordinates is given by $P(r, \theta, \phi) = Nr^2 \cos^2(\theta)e^{-r}$. The value of *N* so that this distribution is normalized is *1 point*

$1/8\pi$

$1/16\pi$

$1/32\pi$

None of the above

Accepted Answers:
$1/32\pi$