

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Kontinua 26 (3/5): The Physics of Gases

Question	Points	Score
1	3	
2	4	
3	0	
4	6	
Total:	13	

Duration: 25 minutes

### Ideal Gas Law

$$PV = nRT$$

where:

$P$  is the pressure in pascals

$V$  is the volume in cubic meters

$n$  is the number of molecules in moles

$R$  is the molar gas constant: 8.31446

$T$  is the temperature in Kelvin

### Binomial Distribution

$$f(x; n, p) = b(x; np) = \binom{n}{x} p^x (1-p)^{n-x}$$

$$\mu = E(x) = np$$

$$\sigma_x^2 = np(1-p)$$

1. (3 points) In a particular game, a fair die is tossed. If the number of spots showing is either 4 or 5 you win \$1, if the number of spots showing is 6 you win \$4, and if the number of spots showing is 1, 2, or 3 you win nothing. Let  $X$  be the amount that you win. What is the expected value of  $X$ ?



2. (4 points) The weight of written reports produced in a certain department has a Normal distribution with mean 60 g and standard deviation 12 g. The probability that the next report will weigh less than 45 g is
- a) 0.1056
  - b) 0.3944
  - c) 0.1045
  - d) 0.8944

3. (4 points) Complete these equations: (2 points per equation)

$$\frac{2}{5} + \frac{3}{7} =$$

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4. A reservation service employs five information operators who receive requests for information independently of one another, each according to a Poisson process with rate  $\mu = 2$  per minute.
- (a) (3 points) What is the probability that during a given 1-min period, the first operator receives no requests?
  - (b) (3 points) What is the probability that during a given 1-min period, exactly four of the five operators receive no requests? (*Hint*: treat either as a binomial process of 5 trials with 4 successes or consider 5 combinations of Poisson processes, e.g. only 1st operation receives a request or only 2nd operation receives a request and so on)