1. [3 marks] Consider the following sample of temperature readings (in °C)

Temperature	Frequency
20	6
22	2
25	1

a) Find the mean

$$\bar{x} = \frac{20(6) + 22(2) + 25}{9} = 21°C$$

b) Find the median

20, 20, 20, 20, 20, 20, 22, 22, 25

20°C

c) The sample variance is 3. If each temperature were increased by 1°C, what would the new sample variance be?

Spread doesn't change

new $s^2 = 3$

2. [2 marks] A class of 30 technology students is polled on their TV viewing habits. Twenty of the students watch Netflix. Eighteen of the students watch sports. Twelve of the students watch Netflix and sports. Find the probability that a student watches sports but not Netflix.

	Netflix	No Netflix
Sports	12 →	6
No Sports	↓ 8 →	4

$$P(\text{sports and not Netflix}) = \frac{6}{30} = 0.2$$

3. [3 marks] Find the variance:

x	$P(x)$
2	0.4
3	0.6

$\mu = 2(0.4) + 3(0.6) = 2.6$

$E(x^2) = 2^2(0.4) + 3^2(0.6) = 7$

$\sigma^2 = E(x^2) - \mu^2$

$= 7 - (2.6)^2$

$= 0.24$

4. [2 marks] A ticket for a charity lottery costs \$50. Each ticket has a 98% chance of winning nothing and a 2% chance of winning \$1,000.

Let net gain=(amount won)-(ticket cost). Find the probability distribution of the net gain from one ticket.

X = net gain (\$)

	x	$P(x)$
win	950	0.02
lose	−50	0.98

5. [4 marks] An engineering company is working on six independent projects. Each project has a 10% probability of being completed on time. Find the probability that more than one of the projects are completed on time. Round your answer to two decimal places.

BINOMIAL $n=6$ $p=0.1$ on-time $q=1-p=0.9$

$x = \#$ on-time

$$P(x>1) = P(x=2) + P(x=3) + \ldots$$
$$= 1 - P(x=0) - P(x=1)$$
$$= 1 - 6C0(0.1)^0(0.9)^6 - 6C1(0.1)^1(0.9)^5$$
$$\approx 0.11$$

6. [3 marks] A brand of sheet metal is known to have 2 defects per m^2, on average. Find the probability that a piece of sheet metal with area $2m^2$ has at most one defect. Round your answer to two decimal places.

POISSON $\dfrac{2 \text{ defects}}{m^2} = \dfrac{4 \text{ defects}}{2m^2}$

Use $\lambda = 4$ $x = \#$ defects $/2m^2$

$$P(x \le 1) = P(x=0) + P(x=1)$$
$$= \frac{4^0 e^{-4}}{0!} + \frac{4^1 e^{-4}}{1!}$$
$$\approx 0.09$$

7. [4 marks] The probability density function for X is

$$f(x) = \begin{cases} 0.05x, & \text{if } 3 < x < 7 \\ 0, & \text{otherwise} \end{cases}$$

Find:

a) the probability that X is less than 4

$$P(X<4) = \int_{-\infty}^{4} f(x)\,dx$$

$$= \cancel{\int_{-\infty}^{3} 0\,dx} + \int_{3}^{4} 0.05x\,dx$$

$$= \frac{0.05x^2}{2}\Big|_3^4$$

$$= 0.025(16-9)$$

$$= 0.175$$

b) the mean of X

$$\mu = \int_{-\infty}^{\infty} x f(x)\,dx$$

$$= \cancel{\int_{-\infty}^{3} 0\,dx} + \int_{3}^{7} 0.05x^2\,dx + \cancel{\int_{7}^{\infty} 0\,dx}$$

$$= \frac{0.05x^3}{3}\Big|_3^7$$

$$= \frac{0.05}{3}(7^3-3^3)$$

$$= 5.27$$

8. [4 marks] The droplet size for water sprayed through a nozzle is normal with a mean of 1200μm and a SD of 160μm. Find the probability that a droplet has size:

a) between 1150μm and 1500μm

NORMAL $\quad z = \dfrac{x-\mu}{\sigma} \qquad z_1 = \dfrac{1150-1200}{160} \simeq -0.31 \qquad z_2 = \dfrac{1500-1200}{160} \simeq 1.88$

$P(1150 \le x \le 1500)$

$= P(-0.31 \le z \le 1.88)$

$=$

$= 0.1217 + 0.4699$

$= 0.5916$

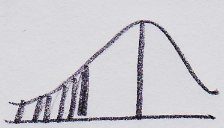
b) less than 1000μm

$$z = \frac{1000-1200}{160} = -1.25$$

$P(x < 1000)$

$= P(z < -1.25)$

$=$



$= 0.5 - 0.3944$

$= 0.1056$