Probability Exercises:
https://www.khanacademy.org/math/statistics-probability/probability-library/basic-theoretical-probability/e/probability_1?modal=1
Section 1:
Q1. There are 20 PC's in P1160, three of which are not working. If two students enter the lab together what is the chance that they both select a faulty PC to work at?

3/20*2/19 = 0.01578947

Q2. If you roll two dice what is the probability that they are both even?

3/6*3/6 =9/36 =1/4

Help on questions 1-2
https://www.khanacademy.org/math/statistics-probability/probability-library/multiplication-rule-independent/e/independent_probability?modal=1

Q3. If you roll a die what is the probability that you get a two OR a number greater than four?
1/6 + 2/6 = 3/6=1/2

Q4. If you roll a die what is the probability that you get a two OR an EVEN face?
1/6 + 3/6 – 1/6 = 3/6 =1/2

Q5. If you select a card from a shuffled deck, what's the probability it's a QUEEN OR a DIAMOND?
4/52 + 13/52 – 1/52 =16/52 =4/13
Help on questions 3-5:
https://www.khanacademy.org/math/statistics-probability/probability-library/addition-rule-lib/e/adding-probability?modal=1

Section 2:
Question 1.
A batch of 50 computers contains 7 with faults. If two computers are selected at random without replacement. Calculate the probability that

(i) Both are defective
7/50*6/49 = 3/175= 0.01714286

(ii) Neither are defective
43/50*42/49 = 129/175 = 0.7371429

(iii) Exactly one of the two computers has a fault
1st comp has fault & 2nd doesn't OR 1st has no fault & 2nd does
7/50*43/49 + 43/50*7/49= 0.2457143 = 43/175
https://www.khanacademy.org/math/statistics-probability/probability-library/multiplication-rule-independent/e/compound-events?modal=1

(iv) At least one of the two computers has a fault.

1-P(None) = 1 -129/175 = 46/175 = 0.2628571

Same answer if you

P(both have faults) or P(only one has a fault) =3/175 + 43/175 = 46/175

https://www.khanacademy.org/math/statistics-probability/probability-library/multiplication-rule-independent/e/probability-at-least-one-success?modal=1

Question 2.

Suppose you draw three cards at random and without replacement from a shuffled deck. Calculate the probability that

(i) all three cards are aces

4/52*3/51*2/50 =1/5525 = 0.00018

(ii) the first card is a jack, the second a queen and the third a king.

4/52*4/51*4/50 = 8/16575 = 0.00048265

https://www.khanacademy.org/math/statistics-probability/probability-library/multiplication-rule-independent/e/compound-events?modal=1

Question 3.

This time you only draw one card from a deck and then replace the card and shuffle. If you do this three times has your likelihood of getting three aces increased, decreased or stayed the same.

Increases as it is (4/52)^3 =0.0004551661

Section 3:

Question 1.

It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive (a non-spam email detected as spam) is 5%.

Now if an email is detected as spam, then what is the probability that it is in fact a non-spam email?

https://www.khanacademy.org/math/statistics-probability/probability-library/conditional-probability-independence/e/calculating-conditional-probability?modal=1

https://www.khanacademy.org/math/statistics-probability/probability-library/conditional-probability-independence/a/conditional-probability-using-two-way-tables

https://www.khanacademy.org/math/statistics-probability/probability-library/conditional-probability-independence/a/check-independence-conditional-probability

A = event that an email is detected as spam,

B = event that an email is spam,

B'= event that an email is not spam.

Interested in finding the P(B' | A)?

We know P(B) = P(B') = .5, P(A | B) = 0.99, P(A | B') = 0.05.

Hence by the Bayes's formula we have

P(B'| A) = P(A | B')P(B') /P(A)

= P(A | B')P(B') / (P(A | B)P(B) + P(A|B')P(B'))
= 0.05 × 0.5/(0.99 × 0.5 + 0.05 × 0.5) = 5/104 ~= 0.048

Side note P(A) = (P(A | B)P(B) + P(A|B')P(B'))

Question 2:
A company makes Bluetooth headphones. One out of every 60 gadgets is faulty, but the company doesn't know which ones are faulty until a buyer complains. Suppose the company makes a €4 profit on the sale of any working headphones, but suffers a loss of €75 for every faulty set of headphones because they have to repair the unit. Check whether the company can expect a profit in the long term.

E(Profit) = Profit not Faulty * P(not faulty) + Loss when faulty * P(faulty)

$= 4 * \frac{59}{60} + (-75) * \frac{1}{60}$

= €2.68

Can expect a profit long term.

https://www.khanacademy.org/math/statistics-probability/random-variables-stats-library/random-variables-discrete/e/expected_value