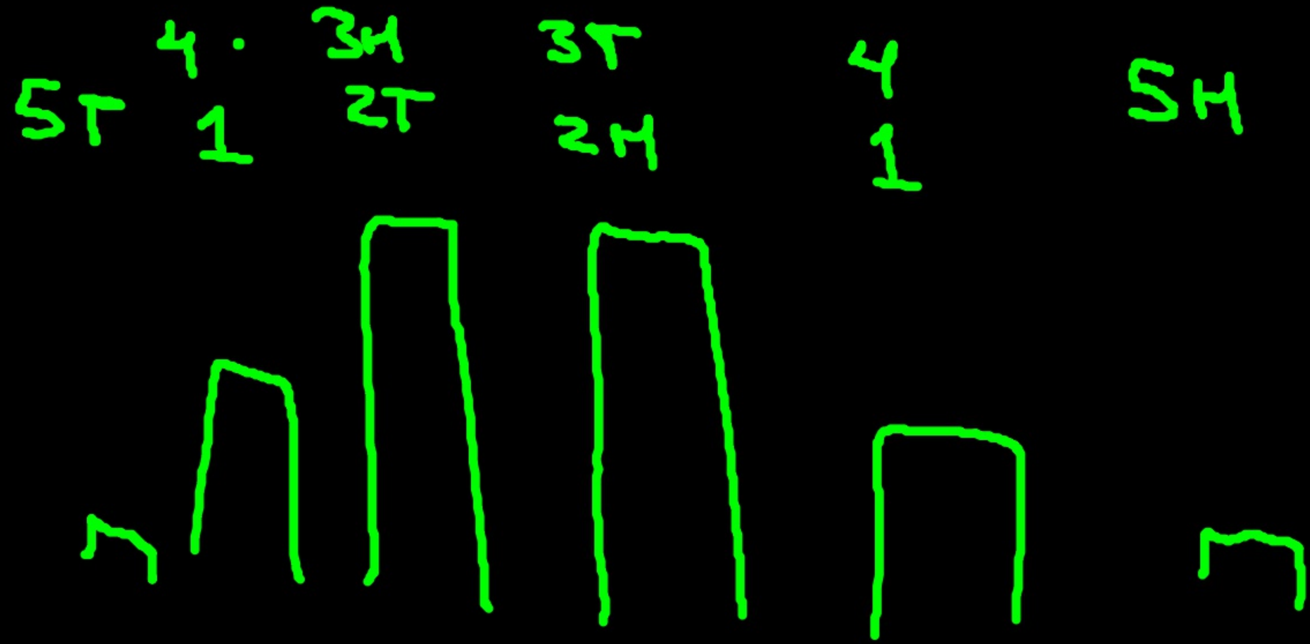
We're going to flip an unbiased coin five times.

What do you expect to happen?

Perform the experiment and record data.

Write your results on the board.



Today's learning objective:

By the end of class, I will be able to identify binomial probability distributions and solve interesting problems with bell curve probability.

Today's language objective:

**I will be able to convert calculator nomenclature to intelligible mathematical vocabulary.

Binomial probability distribution
Bell Curve
Normal Curve
PDF vs CDF

exact cumulative

prob of success

$$X \sim \mathrm{B}(n, p) \quad \Rightarrow \quad \mathrm{P}(X = r) = \binom{n}{r} p^r (1-p)^{n-r}, \ r = 0, 1, \ldots, n$$

total events

number of ~~outcomes~~ instances

prob of success

number of successes

A box holds 240 eggs. The probability that an egg is brown is 0.05.

(a) Find the expected number of brown eggs in the box.

$240 \cdot (.05) = 12$ eggs

(b) Find the probability that there are 15 brown eggs in the box.

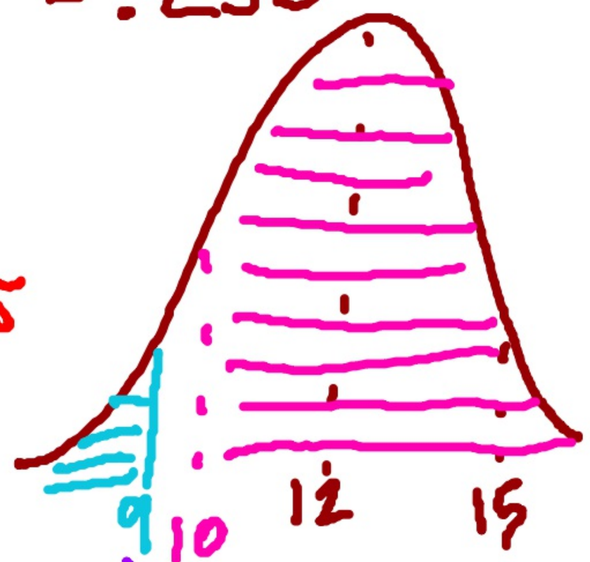
$\boxed{.0733}$ binomPDF (exact)

(c) Find the probability that there are at least 10 brown eggs in the box.

$1 - .236 =$ $\boxed{.764}$

$\binom{n}{r} p^r (1-p)^{n-r} =$ CDF = .236

$\binom{240}{15} .05^{15} (1-.05)^{240-15}$




$\frac{240!}{(240-15)!\,15!}$ 240 nCr 15 2nd VARS

A multiple choice test consists of ten questions. Each question has five answers.
e of the answers is correct. For each question, Jose randomly chooses one of the five answ

)  Find the expected number of questions Jose answers correctly.

$\frac{1}{5} \cdot 10 = 2$

)  Find the probability that Jose answers exactly three questions correctly.

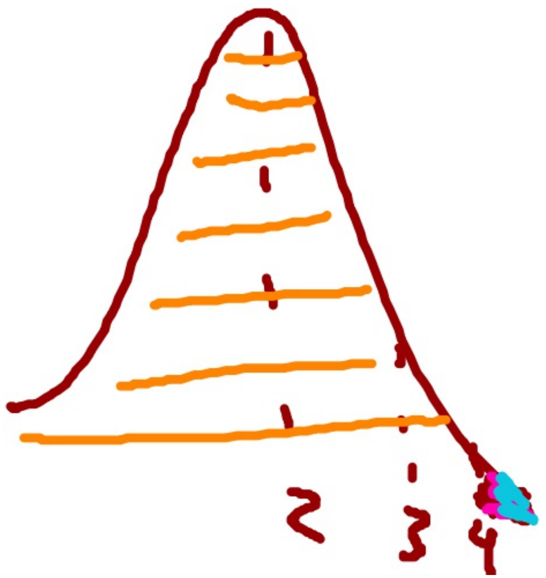
PDF (10, .2, 3) = .201

)  Find the probability that Jose answers more than three questions correctly.

CDF (10, .2, 3) = .879

(Tot

$1 - .879 = .121$



an likes to play two games of chance, A and B.

game A, the probability that Evan wins is 0.9. He plays game A seven times.

Find the probability that he wins exactly four games.

PDF(7, 0.9, 4) = .0230

game B, the probability that Evan wins is $p$. He plays game B seven times.

Write down an expression, in terms of $p$, for the probability that he wins exactly four games.

$$\binom{7}{4} p^4 (1-p)^{7-4} = .15$$

Hence, find the values of $p$ such that the probability that he wins exactly four games is 0.15.

$$\frac{7!}{(7-4)!\,4!} = 35p^4(1-p)^3 - 0.15 = 0$$

$p = 0.356$ ; $0.770$

**(Total 7 ma**

distribution

$$X \sim \mathrm{B}(n, p) \Rightarrow \mathrm{P}(X = r) = \underline{\binom{n}{r} p^r (1-p)^{n-r}}, \; r = 0, 1, \ldots, n$$

3.) Jan plays a game where she tosses two fair six-sided dice. She wins a prize if the sum of her scor

(a) Jan tosses the two dice once. Find the probability that she wins a prize.

$4/36 = 1/9$

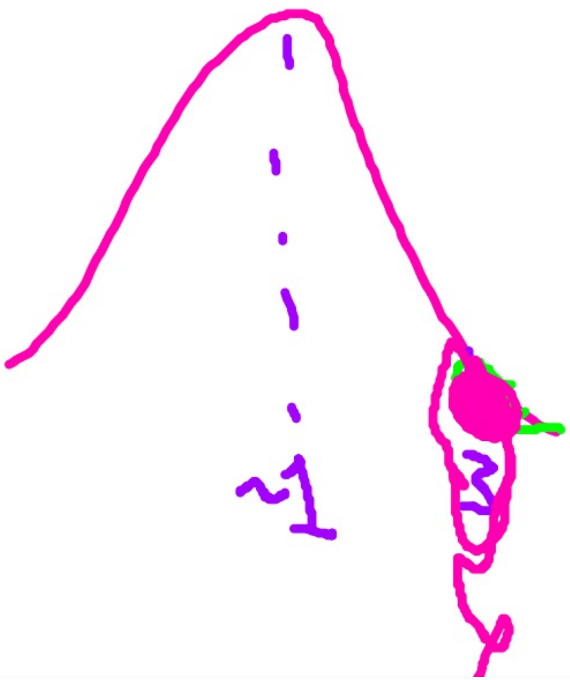
(b) Jan tosses the two dice 8 times. Find the probability that she wins 3 prizes.

PDF $(8, 1/9, 3)$

**(Total 5 ma**

4.26%

.0426



. factory makes switches. The probability that a switch is defective is 0.04.

e factory tests a random sample of 100 switches.

Find the mean number of defective switches in the sample.

$100(.04) = 4$

Find the probability that there are exactly six defective switches in the sample.

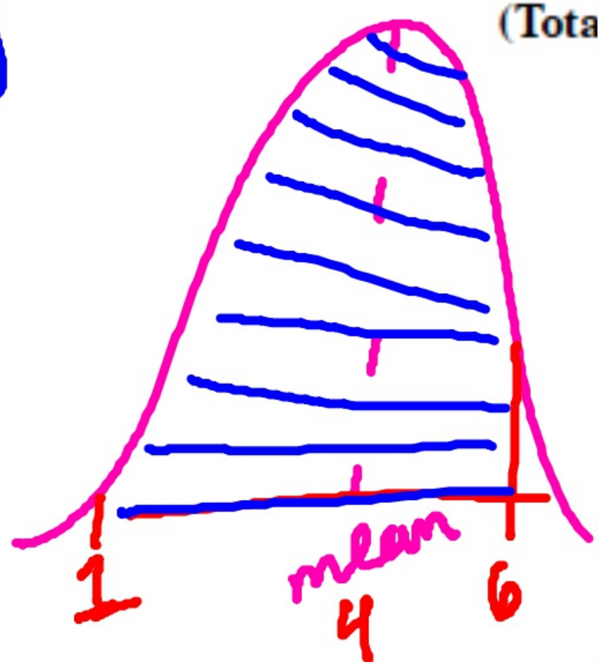
$\binom{100}{6} .04^{6} (1 - .04)^{94} = .105$

Find the probability that there is at least one defective switch in the sample.

$\binom{100}{0} .04^{0} (1 - .04)^{100} = \boxed{.983}$

(Tota

$\binom{n}{r} p^{r} (1-p)^{n-r}$



aula goes to work three days a week. On any day, the probability that she goes on a red bu

Write down the expected number of times that Paula goes to work on a red bus in one week.

one week, find the probability that she goes to work on a red bus

on exactly two days;

on at least one day.

**(Tot**

15.) A test has five questions. To pass the test, at least three of the questions must be answered correctly.

The probability that Mark answers a question correctly is $\frac{1}{5}$. Let $X$ be the number of questions that Mark answers correctly.

(a) (i) Find $E(X)$.

(ii) Find the probability that Mark passes the test.

**(6)**

Bill also takes the test. Let $Y$ be the number of questions that Bill answers correctly.
The following table is the probability distribution for $Y$.

| $y$ | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| $P(Y = y)$ | 0.67 | 0.05 | $a + 2b$ | $a - b$ | $2a + b$ | 0.04 |

(b) (i) Show that $4a + 2b = 0.24$.

(ii) Given that $E(Y) = 1$, find $a$ and $b$.

**(8)**

(c) Find which student is more likely to pass the test.

**(3)**

**(Total 17 marks)**

21.) A van can take either Route A or Route B for a particular journey.

If Route A is taken, the journey time may be assumed to be normally distributed with mean 46 minutes and a standard deviation 10 minutes.

If Route B is taken, the journey time may be assumed to be normally distributed with mean $\mu$ minutes and standard deviation 12 minutes.

(a) For Route A, find the probability that the journey takes **more** than 60 minutes.

**(2)**

(b) For Route B, the probability that the journey takes **less** than 60 minutes is 0.85. Find the value of $\mu$.

**(3)**

(c) The van sets out at 06:00 and needs to arrive before 07:00.

(i) Which route should it take?

(ii) Justify your answer.

**(3)**

(d) On five consecutive days the van sets out at 06:00 and takes Route B. Find the probability that

(i) it arrives before 07:00 on all five days;

(ii) it arrives before 07:00 on at least three days.

**(5)**

**(Total 13 marks)**