Personal Finance: Summer Packet

Due on the first day of class

Name: _____

Welcome to Personal Finance!

The course you're about to take is rather different that the math classes you've taken this far in your high school careers. While this is still a math class and your skills from all your previous math classes will be useful, this course is *interdisciplinary* in nature, meaning that you will be expected to use your skills from other subjects in order to succeed. I find that running Personal Finance in this way levels the playing field, since this class is often made up of students of all mathematical skill levels, who all deserve a reasonable challenge.

Like the class as a whole, this assignment is a little bit different than a traditional math summer assignment as well. For each of the math sections, I have provided an overview of the topic and a couple model problems to try to help you. Because of all the overview, this assignment is not as long as it looks! You are also welcome to use any online resource at your disposal (I especially recommend Khan Academy). If you choose to use an online resource, please indicate on which problems you used it, so I know where you had some difficulty. It's okay to get help– in fact, I expect you to in some cases– just be honest about when and where you did.

For the reading and writing component, it should be fairly straightforward. Read and mark up the article as you go, and work thoroughly. I'm a math teacher– I'm not looking for the absolute, most proper academic writing– but I do expect you to organize your thoughts in a clear manner. You will prepare points for discussion as well as summarize your thoughts in a brief reflection.

As of right now, I'm supposed to teach this class in the fall, and **I plan to count this assignment as a series of homework grades. There will also be a quiz on this content within the first few days of class.** However, things often change over the summer; no matter who your teacher is in the fall, assume that this assignment will count as a grade and that the content will be assessed in some way.

You must show all work to receive full credit, and work should be completed neatly and thoroughly, preferably in pencil. In the interest of saving some paper, I didn't provide a lot of room to complete this assignment, so **please work on separate sheets of paper, and attach them to this packet before submitting.** You will find your calculator helpful at times, but please show enough setup so I can follow your work.

If you have any questions at all over the summer, please reach out to me! My email is **rcox@theproutschool.org**. I would be happy to Zoom with you on a case-by-case basis if you're having difficulty.

Have a great summer!

- Mr. Cox

1 Math content review

1.1 Manipulating functions

Evaluating functions

We can think about a function as a machine with an operating system. A function f (which is the name of our machine) is a rule (operating system) relating inputs to outputs. Every input x in the *domain* must go to exactly one output y in the *range*. It's okay to have two inputs go to the same output–we can have two computer commands for the same function, for example–but we can never have one input go to two different outputs.

We typically notate our functions algebraically by the function's name and the variable it takes as an input: $f(x)$, for example. Then we define the rule: $f(x) = x^2 + 1$. So, this function's "operating system" takes every input, squares it, and adds one. It doesn't matter what we put inside. Even this is perfectly acceptable:

$$f(\ \ ) = (\ \ )^2 + 1$$

Which, I think, shows even more clearly that whatever I plug in to f as an input is what is applied to the function's rule:

$$f(2x) = (2x)^2 + 1 = 4x^2 + 1$$
$$f(3) = 3^2 + 1 = 10$$

We call this process *evaluating* a function.

1-4. Let $f(x) = 2x^2 + 3x - 5$. Find the following, and simplify completely.

1. $f(-1)$
2. $f(3)$
3. $f(0.5)$
4. $f(3x)$

5-8. Let $g(x) = \dfrac{1}{2x+7}$. Find the following, and simplify completely.

5. $g(-2)$
6. $g(10)$
7. $g(2t+7)$
8. $g(t^2)$

Operations with functions

For four of our operations, the rule is simple: *whatever operation is present in parentheses, do that operation between the two functions.* So, we can define addition, subtraction, multiplication, and division for functions:

$$(f+g)(x) = f(x) + g(x) \qquad (f-g)(x) = f(x) - g(x)$$

$$(fg)(x) = f(x) \cdot g(x) \qquad \left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)},\ g(x) \neq 0$$

For example, let $f(x) = x + 1$ and $g(x) = x^2 - 2x$:

$$\begin{aligned}(f+g)(x) &= f(x) + g(x) \\ &= (x+1) + (x^2 - 2x) \\ &= x^2 - x + 1\end{aligned}$$

$$\begin{aligned}(f-g)(x) &= f(x) - g(x) \\ &= (x+1) - (x^2 - 2x) \\ &= 1 + 3x - x^2\end{aligned}$$

$$\begin{aligned}(fg)(x) &= f(x) \cdot g(x) \\ &= (x+1)(x^2 - 2x) \\ &= x^3 - x^2 - 2x\end{aligned}$$

$$\begin{aligned}\left(\frac{f}{g}\right)(x) &= \frac{f(x)}{g(x)} \\ &= \frac{x+1}{x^2 - 2x}\end{aligned}$$

Things get slightly more complicated when we talk about *composition* of functions, defined and notated this way:

$$(f \circ g)(x) = f\big(g(x)\big)$$

Remember how we just talked about evaluating functions? This time, we're "evaluting" a function with another function. Problems 4, 7, and 8 were actually examples of function composition. I find it helpful to rewrite the problem with that substitution, so it looks like those problems, as I do below.

For example, let $f(x) = x^2 + 5$ and $g(x) = x - 1$. Find $(f \circ g)(x)$ and $(g \circ f)(x)$.

$$\begin{aligned}(f \circ g)(x) &= f(g(x)) \\ &= f(x-1) \\ &= (x-1)^2 + 5 \\ &= x^2 - 2x + 1 + 5 \\ &= x^2 - 2x + 6\end{aligned}$$

$$\begin{aligned}(g \circ f)(x) &= g(f(x)) \\ &= g(x^2 + 5) \\ &= (x^2 + 5) - 1 \\ &= x^2 + 4\end{aligned}$$

9-11. For each pair of functions f and g, perform the indicated operation, and evaluate if required. Answers should be simplified fully.

9. $f(x) = x^2 + 1,\ g(x) = 2x - 3$

   a. $(f+g)(x)$ b. $(fg)(x)$ c. $(f \circ g)(x)$

10. $f(x) = x^2 + 2x - 1$, $g(x) = 2x$

    a. $(f \circ g)(x)$ b. $(g \circ f)(x)$ c. $\left(\frac{f}{g}\right)(x)$

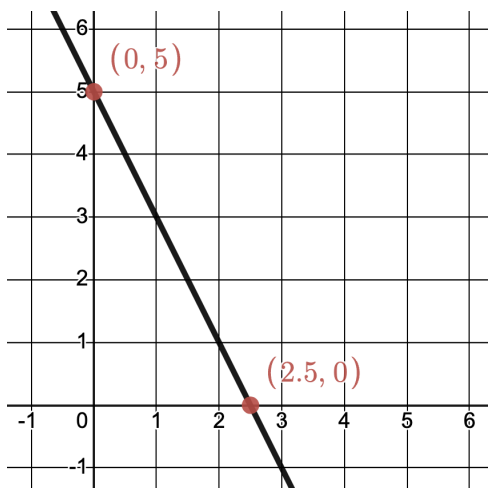
11. $f(x) = x^2 + 1,\ g(x) = 2x - 3$

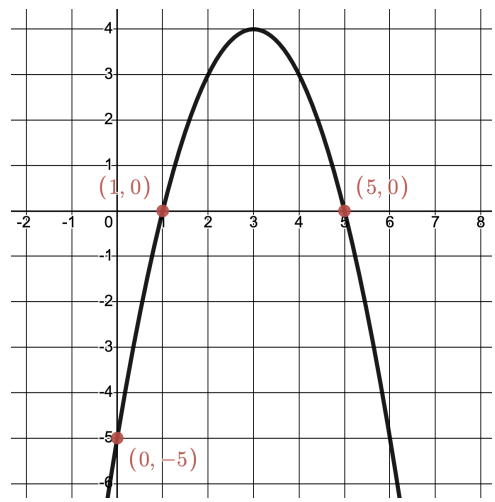
    a. $(f+g)(0)$ b. $(fg)(2)$ c. $(f \circ g)(-3)$

1.2 Analyzing functions and their graphs

Interpreting intercepts

In application problems, the *intercepts* can be useful tools for interpreting data in a real-world context. The *x-intercept* is the point $(x, 0)$ where the graph touches or crosses the x-axis. Similarly, the *y-intercept* is the point $(0, y)$ where the graph touches or crosses the y-axis. In the graphs below, the x- and y-intercepts have been labeled for you.





To find the y-intercepts, evaluate $f(0)$. To find the x-intercepts, solve the equation $f(x) = 0$. In other words, **plug in 0 for the other variable and solve.** For example, for the equation $y = 3x - 1$:

x-intercept:	Let $y = 0$	y-intercept:	Let $x = 0$
$0 = 3x - 1$		$y = 3(0) - 1$	
$1 = 3x$		$y = -1$	
$x = \frac{1}{3}$			

So, the intercepts are $\left(\frac{1}{3}, 0\right)$ and $(0, -1)$. This can also be done on your graphing calculator, and we'll talk about that (and applications) during the year.

12-14. For each of the functions given, find all x-intercepts and y-intercepts.

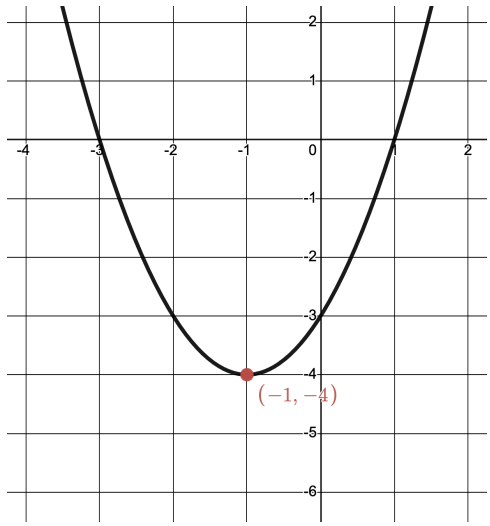
12. $y = 6x + 7$

13. $3x - 4y = 10$

14. $y = x^2 - 4$

Maxima or minima of a parabola

Extrema, the general term for maxima or minima, are also useful in application problems. This year in particular, we'll talk about cases where businesses look for ways to maximize their profit or minimize their costs. In the graph below, the minimum of the parabola is shown.



Two notes:

- There is a calculus method for finding local extrema that some of you in IB may have learned (or will learn). I won't teach that in this class but you're welcome to use it if you know.
- For now, we'll keep the numbers simple, as I haven't taught you the method on your calculator yet. We'll spend a bunch of time on this though during the first unit.

For a quadratic equation in standard form $f(x) = ax^2 + bx + c$, the x-coordinate of the max/min is given by $x = -\dfrac{b}{2a}$. Then, substitute that value into the function to find the y-coordinate. Hence, for $y = 2x^2 - 3x + 1$, the minimum point is $\left(\dfrac{3}{4}, -\dfrac{1}{8}\right)$.

15-18. Find the exact maximum or minimum value for each of the functions given.

15. $y = 3x^2 + 2x - 3$
16. $f(x) = 2 - 4x - x^2$
17. $y = x^2 + 3x - 5$
18. $g(x) = 3 + x - x^2$

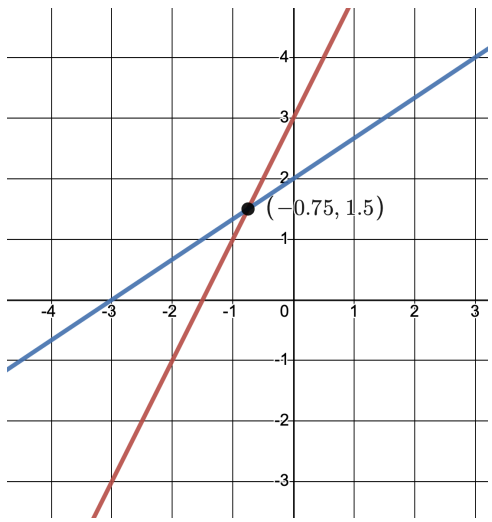
Finding the intersections of graphs

Two graphs *intersect* one another when their function values are equal. Again, there's a calculator way to do this, but we'll focus on solving them by hand for now. Simply set the functions equal to each other and solve for x.

For example, let $f(x) = 2x + 3$ and $g(x) = 3x - 5$ and find their intersection:

$$\begin{aligned} 2x + 3 &= 3x - 5 \\ -x + 3 &= -5 \\ -x &= -8 \\ x &= 8 \end{aligned}$$

Then, substitute the x-value into either function to find the y-coordinate. $f(8) = g(8) = 19$, so the point of intersection here is $(8, 19)$. Using different functions, an intersection looks like this:



19-21. For each pair of functions, determine the point(s) of intersection.

19. $\begin{cases} y = 3x + 5 \\ y = 2x - 7 \end{cases}$

20. $\begin{cases} y = \frac{1}{2}x + 1 \\ y = 3 - x \end{cases}$

21. $\begin{cases} y = 2x + 5 \\ y = 2x^2 + 1 \end{cases}$

1.3 Writing and using algebraic expressions

I get it...word problems can be challenging. Unfortunately, they will be a key part of this year. Let's talk about a couple helpful tips:

- Write down any important details off to the side or in the answer space for a problem.
  - Some teachers tell students to underline or circle within the paragraph, but that doesn't fix the real problem, which is having to pick through the paragraph when you need information.
- As you identify information, assign logical variables to the information you isolate.
- Sort your information into what was *given*, and what your *goal* is.

There's not much to demonstrate here, so try the following problems.

22-25. Write an expression or equation that represents the problem. Then, solve using the given conditions.

22. Adrian is buying tickets for an upcoming Luke Combs concert. Ticketmaster charges him \$74.95 per ticket, plus a flat \$32.08 processing fee for the order. Write an equation for the cost C of buying t tickets, then calculate how much it will cost Adrian to buy 4 tickets.

23. Ella works for Graphic Expressions and is assessing the cost of producing senior class t-shirts. Suppose that it costs Graphic Expressions \$2.50 to buy each shirt plus \$18.14 to run the printing machine for the order. Write an equation for the expense E of producing s shirts, then calculate how much it will cost to produce 102 shirts.

24. Veronica is catching up on *Stranger Things* as season 4 was released. For the sake of this problem, assume that Netflix releases one episode of *Stranger Things* per week (or 1 episode every 7 days). Veronica watches 3 episodes per day to catch up. At the time of writing, there are 32 episodes out.

    (a) Write an expression for the number of episodes n available d days since Veronica started watching.

    (b) Write an expression for the number of episode n Veronica has watched in d days.

    (c) After how many days will Veronica be caught up?

25. Brian and Adam are in a race. Suppose that Brian is running at 8 miles per hour. Adam, however, is running at 6 miles per hour, but gets a $\frac{3}{4}$-mile head start.

    (a) Write an expression for the distance d that Brian covered after t hours.

    (b) Write an expression for the distance d that Adam covered after t hours.

    (c) After how many *minutes* does Brian catch up to Adam?

The second part of this assignment begins on the next page.

2 Talking about personal finance

For this part of the summer assignment, read the two articles attached (hyperlinks also included below). These are your copies to use, so I highly recommend marking them up by underlining important points and making notes in the margins with any questions or thoughts you have as you're reading. (This is also good practice for skills that will be useful when you get to college.) Then, answer the following questions.

- For the questions about each individual article, just jot down some bullet points about your thoughts, reactions, and questions while reading. We'll use these as discussion points in class.
- For the synthesis questions at the end, answer this in more formal academic writing. Use full sentences, paragraphs, and logical organization to form your argument. This should be about 1.5-2 pages long, or about three paragraphs, because you are expected to talk about both articles in detail, plus draw some connects.

New York Times article

Article link: "We're all afraid to talk about money. Here's how to break the taboo." (Kristen Wong, *The New York Times*, 28 August 2018)

1. Why is it so hard to talk about money?
2. Why is a class like Personal Finance so important?

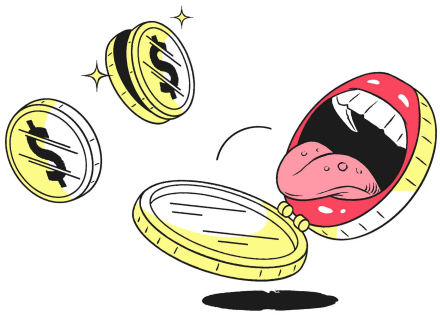
Bank of America article

Article link: "10 online and mobile security tips" (n.a., Bank of America, n.d.)

1. So much of this feels like common sense, especially to a generation that may often take the reliance on technology for granted. Do you think reviewing these tips is still important for you, or is this article directed at a different audience? Why?
2. In a 2017 study from Pew Research Center, only 22% of users, regardless of age, regularly update their apps and operating system. (Source) We know why it's important to run system updates, but why might people across the board so hesitant to do so?

Synthesis

1. In a world that is becoming increasingly more reliant on technology, it's more important than ever to be aware of your own finances and think critically about them. How can we use the digital resources available to us in order to open up conversations about money, so we can become more informed (and help others become more informed) about our finances?



We're All Afraid to Talk About Money. Here's How to Break the Taboo.

It's hard to learn about something when you're discouraged from talking about it.

By Kristin Wong

Aug. 28, 2018

"I want to get my own place. How much is your rent?" a friend once asked. He immediately put his hand over his mouth.

"Sorry," he said. "That's so rude."

Many of us grow up learning that money is one of a few topics — like politics, sex and religion — that you should avoid in polite company. You don't brag about your net worth. You don't share your salary with colleagues. You try not to ask your friends about their rent, even if it helps put your budget in perspective.

We're discouraged from talking about money at every turn, but if you want to fix your financial situation, talking about it is necessary.

Even setting aside that social taboo of discussing money, there are practical hurdles in your way to getting better at money: Learning about money is intimidating, and there's no structural system in place to teach us. Further still, we look at poor money skills as something to be ashamed and embarrassed of, which can keep us from being honest about money and seeking out the right kind of help.

"It's difficult for people to discuss money because there's no real agreed upon standard of measurement for financial metrics," said Shannon McLay, a former financial adviser who left Merrill Lynch to launch The Financial Gym, a financial planning firm in Manhattan.

"We all know physical health numbers, like BMI, weight and clothing sizes, so we can assess where we fall on that spectrum," Ms. McLay said. "Because of a lack of agreed upon financial metrics, people feel fear or shame around what their finances look like."

> Welcome to **Personal Finance Week** at Smarter Living! Catch up on our previous stories in this series: Our Favorite Tools to Stay on Top of Your Finances • What to Do When You're Bad at Money

All of these forces — the social taboo, the intimidation factor, embarrassment — conspire to keep us from talking about money and improving our circumstances. For example, according to data from Fidelity Investments, 43 percent of Americans don't know how much money their spouse makes, yet fighting about money is a top predictor of divorce. When you don't even know your household income, you can pretty much guarantee a financial fight will eventually erupt.

"There are few things that can cause joy, shame, contentment, anxiety and stress the way that money does," said Korrena Bailie, a financial journalist and senior editor of personal finance at Wirecutter, a New York Times company that reviews and recommends products.

"If your finances cause you stress and anxiety, it's natural to want to keep this to yourself because you might feel embarrassed or ashamed about the decisions you made," she said.

Ms. Mclay added: "When you ignore your financial situation, minor problems happening on a regular basis build up to very substantial challenges."

It's time we all change the story and open up about money.

Break the silence. It's hard to learn about something when you're discouraged from talking about it. In that way, silence becomes a tool for oppression.

Student loan servicer Navient, for example, has been sued for misleading borrowers about repayment options, collectively costing those borrowers as much as $4 billion in interest. Wells Fargo made headlines for secretly opening millions of fraudulent customer accounts that generated at least $2.6 million in fees. If you don't pay attention to your finances, there's always someone waiting to take advantage of the fact.

As wages continue to stagnate and the income gap continues to widen, talking and learning about money is crucial for change.

"Not talking about money can have sweeping social effects, like stopping women from getting equal pay for equal work in the workplace," Ms. Bailie said. This issue came up last year with Google in the spotlight. The Department of Labor lawsuit and investigation against the company claimed that "discrimination against women in Google is quite extreme, even in this industry." Google refused to disclose data about employee salary history, according to the suit.

O.K., so you're convinced: Talking about money is important. So how do we begin?

Start small. If you're intimidated by personal finance and unsure of where to start, remember that you don't have to learn everything about money at once.

Start with one financial lesson at a time. If you have a hard time saving, focus your literacy on emergency funds. If you want to get out of debt, research different debt payoff methods. Read a money blog or listen to a money podcast during your work commute. Dedicate just half an hour to financial literacy a day, and you'll be surprised at how much you learn over time.

Schedule money meetings. It's important to make sure you and your partner or spouse are on the same financial page. Set aside time to talk about your finances, Ms. Bailie suggested.

“While it may be convenient to discuss whether you’re spending too much on travel while you’re in the car on a road trip, it can lead to a much healthier conversation if you sit down with a list of topics to discuss,” she said. Pick a regular time to hold money meetings and talk about any financial goals, setbacks and habits. This will help you avoid fighting about those topics in the future.

Here’s some advice on how to have that conversation with a loved one.

Talk to your friends. “I think that speaking with friends about your financial situation is critical for breaking the taboo around money,” Ms. McLay said. The more comfortable you are talking about topics like retirement plans, student loans and budgeting openly among your peers, the more opportunity you have to learn from each other.

“The more we talk about our situations and either accept them or work on improving them, the healthier our relationship with money will get,” she said.

Be more honest about money. Let’s say you want to throw a little extra at your student loan this month, which might mean cutting back on restaurants. When your friends invite you out for sushi, it’s easy to skirt the issue with an excuse like, “I’m busy that night, I need to do laundry.” Try being honest about where you stand with your finances instead.

This also creates the possibility for learning. Maybe your friend tells you how she paid off her loan early, for example. Or maybe she just starts suggesting cheaper hangout alternatives. Either way, you invite better financial habits and solutions when you break the money taboo.

Set a goal. Having a plan for your money may be the best way to get comfortable with it. Ms. McLay said the most successful clients she’s had are the ones who have clearly defined goals for themselves.

“Set three to four financial goals, like saving $5,000 or making $45,000 a year in a job, and start working toward those goals,” she said. “The more financial goals you achieve, the more comfortable you’ll get with your financial situation.”

Find like-minded people. When you’re trying to get more comfortable with money, it helps to surround yourself with people who are on the same page, who have similar goals and are open to talking about those goals. You can use Facebook or LinkedIn to search for local money meetup groups.

There are also online forums and communities, like Ladies Get Paid, Mr. Money Mustache, Rockstar Finance, Reddit Personal Finance or Bogleheads, where members share negotiation tactics, debt payoff strategies and other important money moves.

“There are very few financial problems that improve by ignoring or neglecting them,” Ms. Bailie added. “When you begin to understand the value of being open and transparent about money, it starts to feel like an imperative.”

Illustration by Benedikt Rugar

10 online and mobile security tips

Key takeaways

- Protect your information with proactive steps like using strong passcodes, verifying website addresses and locking your screens
- If an email, link or attachment seems suspicious, don't open it
- Make sure you download apps from a trusted source and keep your technology secure with the latest updates

We're living our lives online—from banking to shopping to posting on social media—and proper internet security is more important than ever. While it may seem obvious, safeguarding your information can be as simple as consistently reviewing your bank accounts and reporting any suspicious activity. But there are other things you also can do to stay safer online. Here are 10 tips to help protect you and your money.

1 Use strong passcodes

Create a strong passcode, one that you can remember and is not easily guessed by a human or computer. We used to think of a password as a word or phrase, but those are now too easy to crack, so the best way to improve your online security is with a passcode. Your passcode should have eight or more characters and include letters, numbers and symbols. Make sure to use different user IDs and passcodes for your financial accounts and for any other sites you use online.

Strong passcode:

ILv4Btng!

Start with a memorable sentence like "I live for boating!" and transform it.

Weak passcode:

password1234

Avoid using passcodes that can be easily guessed or are based on personal information.

Source: https://bettermoneyhabits.bankofamerica.com/en/privacy-security/online-security-privacy-tips

2 Protect personal information

Don't use any part of your Social Security number or any other sensitive information, such as credit card numbers or birthdays, as a passcode, user ID or personal identification number (PIN). If someone gains access to this information, it may be among the first things used to try to get into your account.

3 Be alert for suspicious emails

Don't respond to suspicious emails that claim to be from your bank, the IRS or any other company requesting your account details. No bank or government agency is ever likely to approach you this way to ask for personal information. A quick glance at the email address might help determine validity—if a company name is misspelled or the email is from a public domain, it's probably not a legitimate email.

4 Verify email attachments

It's never a good idea to click on email attachments, links or free software from unknown sources. This includes those embedded in messages from social networking sites, even if they appear to be from a friend. You could end up exposing your computer (and the information on it) to online fraud and theft.

Quick tip

The last three letters of an email attachment can be a tipoff that the file may contain malware. Don't click on files that end with .exe, an unfamiliar combination of letters—such as .jar, .cpl, .bat, .msi, .js and .wsf—or the letter m after common extensions, such as .docm or .pptm.

5 Watch what you share on social media

The more you post about yourself on social networking sites, the easier it might be for someone to use that information to access your accounts, steal your identity and more. Maximizing your privacy settings on social networking sites can also help protect your personal information.

Bank of America, "10 online and mobile security tips"

6 Protect your internet security

Look for security-enabled website addresses that start with "https" (the extra "s" indicates security). These sites take extra measures to help secure your information. This is particularly important if you're making purchases using your credit card. Requests for personal information or calls for immediate action while surfing the web are almost always scams. If you suspect a link might give you a virus or steal personal data, don't click on it. If a suspicious link is sent to you, verify that the sender and where it came from are legitimate.

7 Secure your smartphone

Many mobile devices give you the option of locking your screen, which helps keep data stored on them secure. Depending on your phone, this can come in the form of a passcode, a pattern you draw on your phone's touch screen, or the most secure option: biometrics such as your fingerprint or face.

8 Don't keep sensitive information on your phone

Sensitive information includes your bank account numbers, identification information, passcodes, answers to your security questions and any other personal details. If you bank via mobile app, the information in your app should have additional protections like multifactor authentication to keep your information secure.

9 Think before you download apps

It's a good idea to review the privacy policy and understand what personal data an app can access before you download. It's best to purchase or download apps from authorized stores to avoid malware.

10 Keep your technology up to date

Make sure to update your computer's operating system, your internet browser and the software on your mobile devices. Updates generally include the latest security patches. Be sure to also use antivirus and antispyware software: These programs help find and remove malicious programs from your computer.

By following these online and mobile security tips, you can help protect your personal information from falling into the wrong hands. If you suspect information related to your bank account has been compromised, contact your bank immediately for assistance addressing the issue.