Welcome To Math 34A! Differential Calculus

Instructor:

Trevor Klar, trevorklar@math.ucsb.edu

South Hall 6431X (Grad Tower, 6th floor, blue side, first door on the right)

Office Hours:

MTWR after class 2:00-3:00, and by appointment. Details on Gauchospace.

Word Problems

For every word problem, it's a good idea to:

- Draw a picture
- Label what you know in the figure
- Write down any formulas you think might be relevant
- Try to solve for the required variable

Travel problems

Key Formula: $$\text{average rate} = \frac{\text{distance}}{\text{time}}$$

Equivalent versions: $$\text{distance} = \text{rate} \times \text{time}$$

$$d = rt$$

Travel problems

2. The Santa Barbara airbus leaves LAX at 3pm and drives to UCSB at an average speed of 30 mph. You leave UCSB at 3pm driving at 90 mph towards LAX. What time do you whiz past the airbus?

A = 1pm B = 3:30pm C = 4pm D = 4:45pm E = 5pm

Answer: C

3. Same question, same choices, but now you leave UCSB at 4pm:

Answer: D

Another Word Problem

4. Two numbers add up to give 17 and their product is 60. What is the larger of the two numbers?

Method / Plan:

(i) Name the two unknowns
(ii) create two equations
(iii) solve equations.

To solve: use one equation to eliminate one unknown from second equation, then factor the resulting quadratic.

A= I have answer B= working C=help

Another one!

5. A rectangle has perimeter 34 inches and area 60 square inches. What is the length of the shortest side?

A= I have answer B= working C=help

Inverse Functions

Idea: You can plug in a power cord
Inverse is to unplug the cord.

Example: $f(x) = 3x - 2$ is a function of x
Inverse is $f^{-1}(y) = (y + 2)/3$

General idea: The inverse of $y = f(x)$ is $x = f^{-1}(y)$
Solve for x in terms of y

Example again: $y = 3x - 2$ is a function $f(x)$
Inverse is $x = f^{-1}(y) = (y + 2)/3$

More Examples

Try these, clicking as you go...

Click	$y = f(x)$	$x = f^{-1}(y)$
A	$y = 5x$	$x = y/5$
B	$y = x + 7$	$x = y - 7$
C	$y = 3x - 4$	$x = (y + 4)/3$
D	$y = x^3$	$x = \sqrt[3]{y} = y^{1/3}$
E	$y = 2^x$	$x = ???? \log_2(y)$

Converting Temperature

x = temperature in Celsius y = temperature in Fahrenheit

This table shows how to convert between Fahrenheit and Celsius.

^oC	0	10	**20**	30	40	50	60	70	80	90	100
^oF	32	50	**68**	86	104	122	140	158	176	194	212

There is a function f that converts the temperature x in Celsius to the temperature y in Fahrenheit: $y = f(x)$

Example $f(20) = 68$ means **20**^oC is **68**^oF

The inverse function $x = f^{-1}(y)$ converts Fahrenheit back into Celsius
Example: $f^{-1}(68) = 20$

You can use a table of data two ways:

- Using it forwards gives you the function f
- Using it backwards gives you the inverse function f^{-1}

^oC	0	10	**20**	30	40	50	60	70	80	90	100
^oF	32	50	**68**	86	104	122	140	158	176	194	212

6. Find $y = f(x)$, the function that gives $y\,^\circ$F from $x\,^\circ$C.

A $y = 9x/5$ B $y = 9(x+32)/5$ C $y = (9x/5)+32$ D $y = (9x+32)/5$

Answer: C

7. Find $x = f^{-1}(y)$, the function that gives $x\,^\circ$C from $y\,^\circ$F.

A $x = 5y/9$ B $x = (5y+32)/9$ C $x = (5y/9)+32$ D $x = 5(y-32)/9$

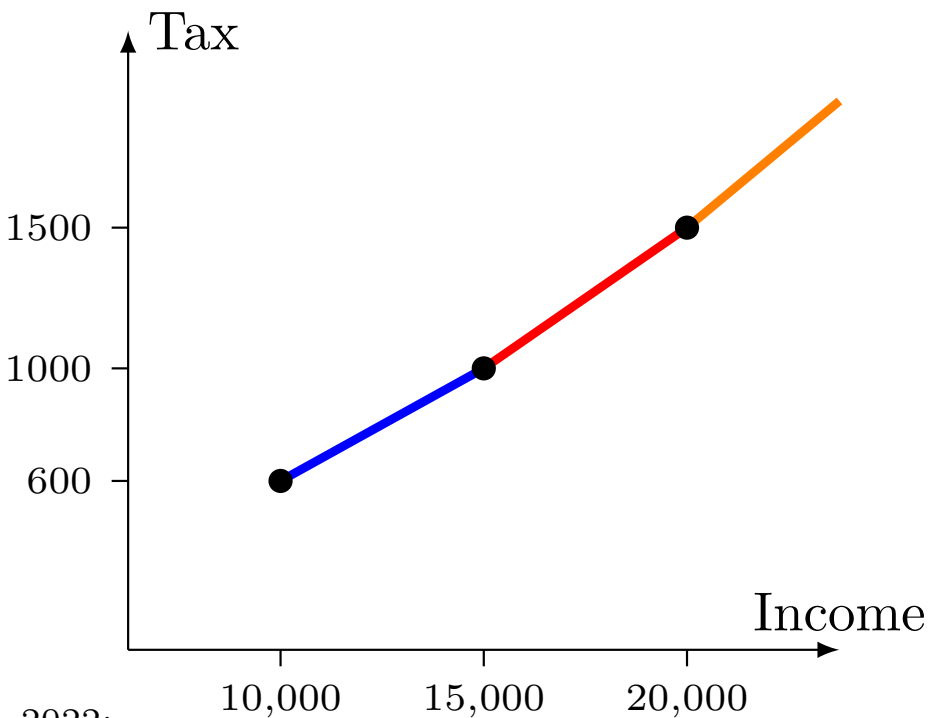
Answer: D

8. What temperature is the same in both Celsius and Fahrenheit?

A -50° B -40° C -30° D -20° E -10° B

Tax Table

Income	\$10,000 to \$14,999	\$15,000 to \$19,999	\$20,000 and over
Tax	\$600+ 8% of amount over \$10,000	\$1,000+ 10% of amount over \$15,000	\$1,500+ 12% of amount over over \$20,000



There are 3 tax brackets

10K to 15K
15K to 20K
above 20K

Tax, continued

Income	\$10,000 to \$14,999	\$15,000 to \$19,999	\$20,000 and over
Tax	\$600+ 8% of amount over \$10,000	\$1,000+ 10% of amount over \$15,000	\$1,500+ 12% of amount over over \$20,000

9. If you earn \$12,500, how much tax do you pay?
read page 27

A \$600 B \$700 C \$800 D \$900 E \$1,000 C

10. If you pay \$1,200 in tax, how much do you earn?

A \$16,000 B \$17,000 C \$18,000 D \$20,000 B

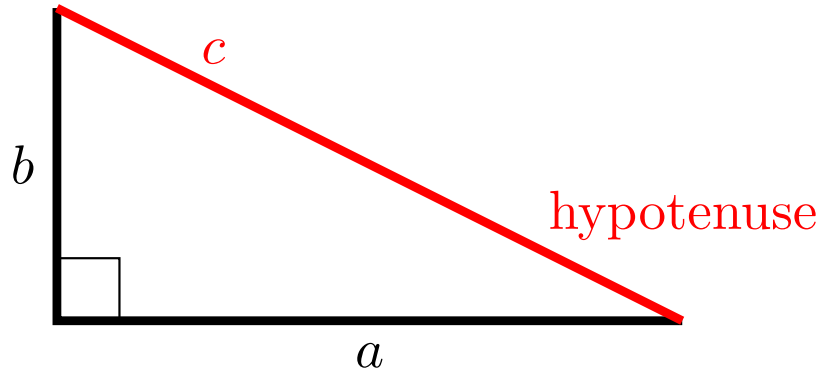
Tax, continued some more

Income	$\$10,000$ to $\$14,999$	$\$15,000$ to $\$19,999$	$\$20,000$ and over
Tax	$\$600+$ 8% of amount over $\$10,000$	$\$1,000+$ 10% of amount over $\$15,000$	$\$1,500+$ 12% of amount over over $\$20,000$

If $x =$ income and $y =$ tax, then

- $f(x) = y$ is the function with input income and output tax
- The inverse function $x = f^{-1}(y)$ has input tax and output income

§1.7: Pythagoras' Theorem



$$c^2 = a^2 + b^2$$

11. What is the length of the hypotenuse of a right triangle when the other two sides have length 3 and 4?

A $= 3$ B $= 4$ C $= 6$ D $= 25$ E = none of these **E**

12. Now lengths are 2 and 3. What's the hypotenuse?

A $= \sqrt{5}$ B $= \sqrt{13}$ C $= 13$ D $= 5$ **B**

13. Lengths $3x$ and $4x$. What's the hypotenuse?

A $= 5 + x$ B $= 5x^2$ C $= 25x$ D $= 5x$ **D**

Pythagorean Theorem Applications

This is very useful to calculate how far apart two things are.

14. You and Marie are in Vegas. You drive north at 40 mph and Marie drives east at 30 mph. How far apart are you after 1 hour?

Click A when you have the answer.

15. How many miles apart are you after t hours?

$$\text{A } = 50t \quad \text{B } = 50 + t \quad \text{C } = 50t^2 \quad \text{D } = 2500t^2 \quad \boxed{\text{A}}$$

That's it. Thanks for being here.