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Chapter 5 Review

For each type of question, the achievement level is indicated. Showing work is an important strategy in communicating your knowledge and ideas so please be thorough.

Learning Goal 5.1	Graphing primary trigonometric functions, including transformations and characteristics

Developing

1. Determine the amplitude, vertical displacement, maximum and minimum of the following trigonometric functions.

a. $y = 3\sin 2x$

Amp.	V.D.	Max	Min
3	0	3	-3

b. $y = 4\cos 3x - 1$

Amp.	V.D.	Max	Min
4	$1\downarrow$	3	-5

c. $y = -7\cos\frac{1}{3}\left(x - \frac{\pi}{4}\right)$

Amp.	V.D.	Max	Min
7	0	7	-7

d. $y = -4\sin\frac{1}{2}\left(x - \frac{\pi}{6}\right)$

Amp.	V.D.	Max	Min
4	0	4	-4

e. $y = 8\sin 2\left(x + \frac{\pi}{12}\right) - 3$

Amp.	V.D.	Max	Min
8	$3\downarrow$	5	-11

f. $y = 6\cos 3\left(x - \frac{\pi}{2}\right) + 4$

Amp.	V.D.	Max	Min
6	$4\uparrow$	10	-2

g. $y = 2\cos 4(x + \pi) + 3$

Amp.	V.D.	Max	Min
2	$3\uparrow$	5	1

h. $y = -3\sin 2\left(x + \frac{\pi}{4}\right) - 5$

Amp.	V.D.	Max	Min
3	$5\downarrow$	-2	-8

i. $y = 5\sin\frac{1}{2}\left(x - \frac{\pi}{12}\right) - 2$

Amp.	V.D.	Max	Min
5	$2\downarrow$	3	-7

j. $y = -9\cos\frac{1}{4}\left(x - \frac{\pi}{3}\right) + 2$

Amp.	V.D.	Max	Min
9	$2\uparrow$	11	-7

k. $y = -3\cos\frac{1}{3}\left(x + \frac{\pi}{3}\right) - 6$

Amp.	V.D.	Max	Min
3	$6\downarrow$	-3	-9

l. $y = 2\sin\left(3x - \frac{\pi}{6}\right) - 3$

Amp.	V.D.	Max	Min
2	$3\downarrow$	-1	-5

m. $y = -4\sin\left(2x - \frac{\pi}{3}\right) + 2$

Amp.	V.D.	Max	Min
4	$2\uparrow$	6	-2

n. $y = -2\cos\left(2x - \frac{\pi}{2}\right) - 5$

Amp.	V.D.	Max	Min
2	$5\downarrow$	-3	-7

o. $y = -3\cos\left(3x - \frac{\pi}{4}\right) - 4$

Amp.	V.D.	Max	Min
3	$4\downarrow$	-1	-7

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2. Determine the period and phase shift of the following trigonometric functions.

a. $y = 3\sin 2x$

Period	Phase Shift
π	0

b. $y = 4\cos 3x - 1$

Period	Phase Shift
$\frac{2\pi}{3}$	0

c. $y = -7\cos\frac{1}{3}\left(x - \frac{\pi}{4}\right)$

Period	Phase Shift
6π	$\frac{\pi}{4} \rightarrow$

d. $y = -4\sin\frac{1}{2}\left(x - \frac{\pi}{6}\right)$

Period	Phase Shift
4π	$\frac{\pi}{6} \rightarrow$

e. $y = 8\sin 2\left(x + \frac{\pi}{12}\right) - 3$

Period	Phase Shift
π	$\frac{\pi}{12} \leftarrow$

f. $y = 6\cos 3\left(x - \frac{\pi}{2}\right) + 4$

Period	Phase Shift
$\frac{2\pi}{3}$	$\frac{\pi}{2} \rightarrow$

g. $y = 2\cos 4(x + \pi) + 3$

Period	Phase Shift
$\frac{\pi}{2}$	$\pi \leftarrow$

h. $y = -3\sin 2\left(x + \frac{\pi}{4}\right) - 5$

Period	Phase Shift
π	$\frac{\pi}{4} \leftarrow$

i. $y = 5\sin\frac{1}{2}\left(x - \frac{\pi}{12}\right) - 2$

Period	Phase Shift
4π	$\frac{\pi}{12} \rightarrow$

j. $y = -9\cos\frac{1}{4}\left(x - \frac{\pi}{3}\right) + 2$

Period	Phase Shift
8π	$\frac{\pi}{3} \rightarrow$

k. $y = -3\cos\frac{1}{3}\left(x + \frac{\pi}{3}\right) - 6$

Period	Phase Shift
6	$\frac{\pi}{3} \leftarrow$

l. $y = 2\sin\left(3x - \frac{\pi}{6}\right) - 3$

$y = 2\sin 3\left(x - \frac{\pi}{18}\right) - 3$

Period	Phase Shift
$\frac{2\pi}{3}$	$\frac{\pi}{18} \rightarrow$

m. $y = -4\sin\left(2x - \frac{\pi}{3}\right) + 2$

$y = 2\sin 2\left(x - \frac{\pi}{6}\right) - 3$

Period	Phase Shift
π	$\frac{\pi}{6} \rightarrow$

n. $y = -2\cos\left(2x - \frac{\pi}{2}\right) - 5$

$y = -2\cos 2\left(x - \frac{\pi}{4}\right) - 5$

Period	Phase Shift
π	$\frac{\pi}{4} \rightarrow$

o. $y = -3\cos\left(3x - \frac{\pi}{4}\right) - 4$

$y = -3\cos 3\left(x - \frac{\pi}{12}\right) - 4$

Period	Phase Shift
$\frac{2\pi}{3}$	$\frac{\pi}{12} \rightarrow$

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3. Determine the period and general equation of the asymptotes of the following trigonometric functions.		
a. $y = 3\tan 2x$	b. $y = 4\tan 3x - 1$	c. $y = -7\tan\frac{1}{3}\left(x - \frac{\pi}{4}\right)$

	Period	Asymptotes
a.	$\frac{\pi}{2}$	$x = \frac{\pi}{4}(2n-1)$, $n \in \mathbb{Z}$
b.	$\frac{\pi}{3}$	$x = \frac{\pi}{6}(2n-1)$, $n \in \mathbb{Z}$
c.	3π	$x = \frac{7\pi}{4} + 3\pi n$, $n \in \mathbb{Z}$

d. $y = -4\tan\frac{1}{2}\left(x - \frac{\pi}{6}\right)$	e. $y = 8\tan 2\left(x + \frac{\pi}{12}\right) - 3$	f. $y = 6\tan 3\left(x - \frac{\pi}{2}\right) + 4$

	Period	Asymptotes
d.	2π	$x = \frac{7\pi}{6} + 2\pi n$, $n \in \mathbb{Z}$
e.	$\frac{\pi}{2}$	$x = \frac{\pi}{6} + \frac{\pi n}{2}$, $n \in \mathbb{Z}$
f.	$\frac{\pi}{3}$	$x = \frac{2\pi}{3} + \frac{\pi n}{3}$, $n \in \mathbb{Z}$

Extending		
4. Graph one period of the trigonometric functions, labelling five coordinates of the **first full period** of the function.		
a. $y = 3\sin 2x$ solution	b. $y = 4\cos 3x - 1$ solution	c. $y = -7\cos\frac{1}{3}\left(x - \frac{\pi}{4}\right)$ solution
d. $y = -4\sin\frac{1}{2}\left(x - \frac{\pi}{6}\right)$ solution	e. $y = 8\sin 2\left(x + \frac{\pi}{12}\right) - 3$ solution	f. $y = 6\cos 3\left(x - \frac{\pi}{2}\right) + 4$ solution
g. $y = 2\cos 4(x + \pi) + 3$ solution	h. $y = -3\sin 2\left(x + \frac{\pi}{4}\right) - 5$ solution	i. $y = 5\sin\frac{1}{2}\left(x - \frac{\pi}{12}\right) - 2$ solution
j. $y = -9\cos\frac{1}{4}\left(x - \frac{\pi}{3}\right) + 2$ solution	k. $y = -3\cos\frac{1}{3}\left(x + \frac{\pi}{3}\right) - 6$ solution	l. $y = 2\sin\left(3x - \frac{\pi}{6}\right) - 3$ solution
m. $y = -4\sin\left(2x - \frac{\pi}{3}\right) + 2$ solution	n. $y = -2\cos\left(2x - \frac{\pi}{2}\right) - 5$ solution	o. $y = -3\cos\left(3x - \frac{\pi}{4}\right) - 4$ solution

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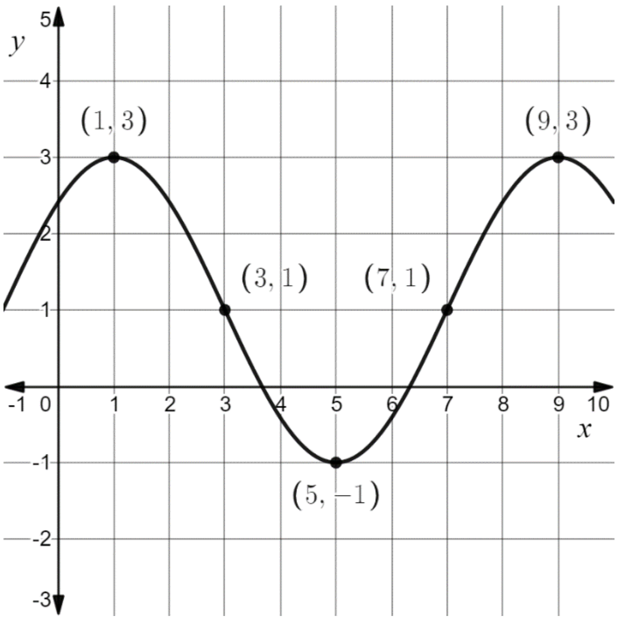
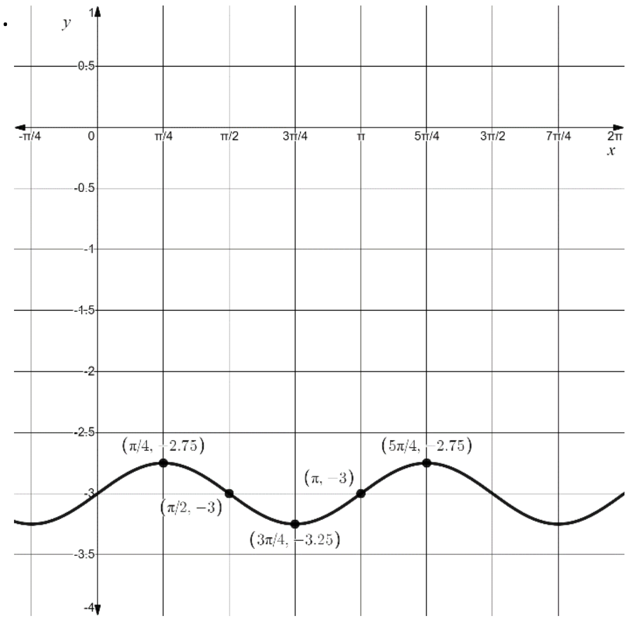
5. Determine the equation of the function from the graph.

a.



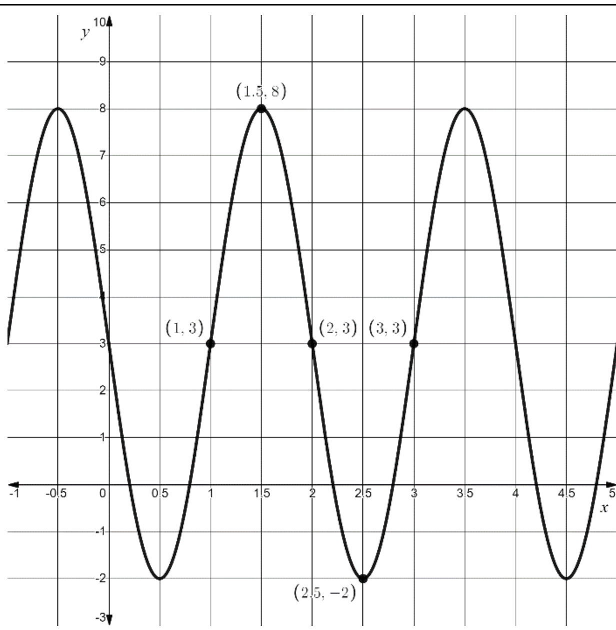
$$y = 2\cos\frac{\pi}{4}(x-1)+1$$

b.



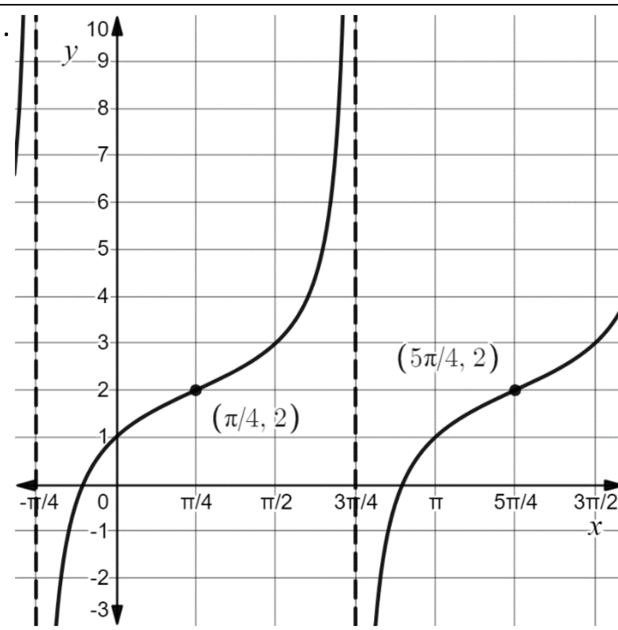
$$y = \frac{1}{4}\cos 2\left(x-\frac{\pi}{4}\right)-3$$

c.



$$y = 5\sin\pi(x-1)+3$$

d.



$$y = \tan\left(x-\frac{\pi}{4}\right)+2$$

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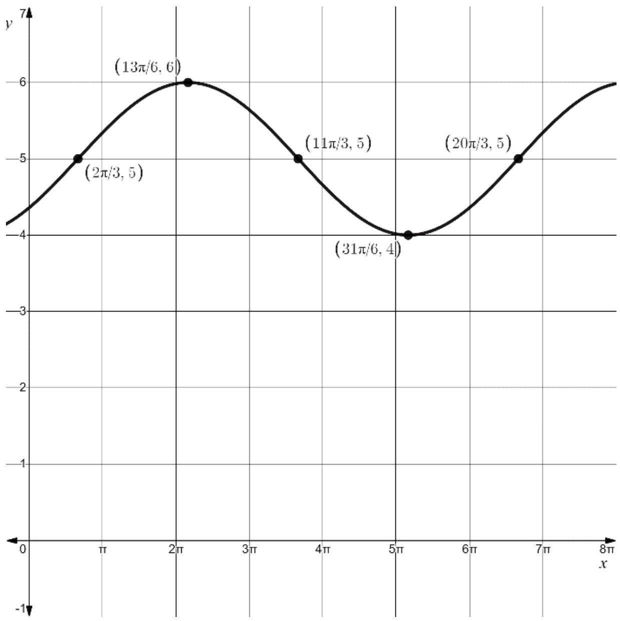
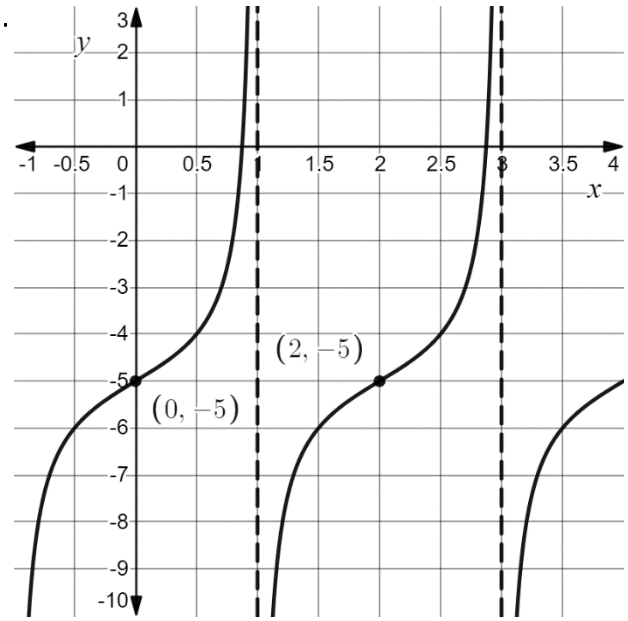
a.



$$y = \sin\frac{1}{3}\left(x - \frac{2\pi}{3}\right) + 5$$

b.



$$y = \tan\frac{\pi}{2}x - 5$$

Extending
6. The average depth of water at the end of a dock is 6 feet. This varies 2 feet in both directions with the tide. Suppose there is a high tide at 4 AM. If the tide goes from low to high every 6 hours, write a cosine function $d(t)$ describing the depth of the water as a function of time with $t = 4$ corresponding to 4 AM. At what two times within one cycle is the tide at a depth of 5 feet? $d(t) = 2\cos\frac{\pi}{6}(t-4) + 6$ $d(8) = d(12) = 5$
7. Ruby has a pulse rate of 73 beats per minute and a blood pressure of 121 over 85. If Ruby's blood pressure can be modeled by a sinusoidal function, find the equation. $b(t) = 18\sin 2\pi t + 103$
8. A mass suspended from a spring is pulled down a distance of 2 feet from its rest position. The mass is released at time $t = 0$ and allowed to oscillate. If the mass returns to this position after 1 second, find an equation that describes its motion. What times, in the first cycle to the nearest tenth of a second, is the spring at 1.5 feet above its rest position? $d(t) = -2\cos 2\pi t$ $d(0.4) = d(0.6) = 1.5$

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9. A group of Moscrop students decided to study the sinusoidal nature of tides. Values for the depth of the water level were recorded at various times, recorded in the table below. Write the equation of the tide height. How deep is the water at 9 PM, to the nearest tenth?

2 AM	8 AM
1.8 metres (low tide)	3.6 metres (high tide)

$$h(t) = -0.9\cos\frac{\pi}{6}(t-2)+2.7$$
$$h(21) = 3.5 \text{ metres}$$

10. An object hangs from a spring in a stable position. The spring is pulled 3 feet downward and the object begins to oscillate, making one complete oscillation every 4 seconds. Find the equation of the motion of this object. At what times, to the nearest tenth, during the first cycle is the spring 2 feet below the equilibrium position?

$$h(t) = -3\cos\frac{\pi}{2}t$$
$$t(0.5) = t(3.5) = -2$$

11. When you board a ferris wheel your feet are one foot off the ground. It takes 30 seconds for the ride to complete one full revolution with a maximum foot height of 100 feet. Write a trigonometric equation for your height above the ground at t seconds after the ride starts. At what times, to the nearest tenth, during the first round are you exactly 90 feet off the ground?

$$h(t) = -\frac{99}{2}\cos\frac{\pi}{15}t+\frac{101}{2}$$
$$h(11.9) = h(18.1) = 90$$

12. At high tide the water level at a particular boat dock is 9 feet deep. At low tide the water is 3 feet deep. On a certain day the low tide occurs at 3 AM and high tide occurs at 10 AM. Find the equation for the height of the tide at time t. What is the water level at 2 PM to the nearest tenth?

$$h(t) = -3\cos\frac{2\pi}{7}(t-3)+6$$
$$h(14) = 5.3 \text{ feet}$$