Name: Aiden Kim Date:_____

Math 10/11 Honors HW Section 4.1 Review on Basic Trigonometry:

1. When I use regular trigonometric functions like sine, cosine, and tangent, does it only work for right triangles? Or can I use it for all different types of triangles?

   Only right triangles, because the ratios require a hypoteneuse, only obtainable on a right triangle.

2. When I sine an angle like 60°, it gives me a value like 0.866025403. What does this number represent?

   That value is the opposite side's length divided by the hypoteneuse's length.

   opposite side of the angle

3. There are 2 similar right triangles where one is three times bigger than the other. They are both $45^\circ - 45^\circ - 90^\circ$ triangles. If I cosine the 45° in the smaller triangle, will it give me the same value when I cosine the 45° of the bigger triangle? Why or why not?

   Yes, because the ratios of the sides would be the same, as A/H and 3A/3H.

4. When I cosine or sine any angle in a right triangle (except the 90°) will I ever get a value greater than 1? Why or why not?

   No because the hypoteneuse is the longest side of a triangle, and so $\frac{A}{H}$ or $\frac{O}{H}$ will always be less than 1.

5. When I use tangent on any angle in a right triangle (except the 90°) will I ever get a value greater than 1? Why or why not?

   Yes because the opposite side could be greater than the adjacent side, and $\frac{O}{A}$ would be greater than 1.

6. What does the inverse trigonometric function do? Ie: $\sin^{-1}, \cos^{-1}$, or $\tan^{-1}$. What is the purpose of these inverse functions?

   It uses the ratios of sides and converts them into angles. It is used when you're looking for an angle instead of a side length.

7. What does SOHCAHTOA stand for?

   It stands for Sine = Opposite/Hypoteneuse, Cosine = Adjacent/Hypoteneuse, Tangent = Opposite/Adjacent

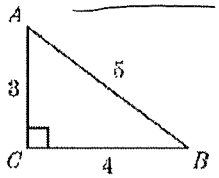
8. When I take sine 45 and divide it by cosine 45, does it equal to tangent 45? Why is it equal? Does sine an angle divided by cosine an angle always to tangent the angle? Why or why not?

   Yes, $\sin\theta / \cos\theta = \tan\theta$. This is because $\sin = \frac{Opp}{Hyp}$, $\cos = \frac{Adj}{Hyp}$, and when $\frac{Opp}{Hyp} \div \frac{Adj}{Hyp}$, it equals $\frac{Opp}{Adj}$ which is tangent.

9. Find the ratios of the following functions and then solve for the angle:

a) $\sin A = \frac{4}{5}$

$A = 53.13^\circ$

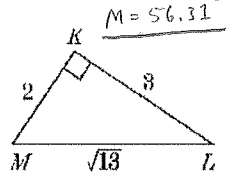


$\cos B = \frac{4}{5}$

$B = 36.87^\circ$

b) $\cos M = \frac{2}{\sqrt{13}}$

$M = 56.31^\circ$

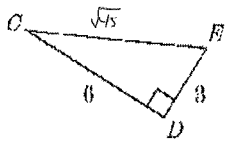


$\tan L = \frac{2}{3}$

$L = 33.69^\circ$

c) $\tan E = 2$

$E = 63.43^\circ$

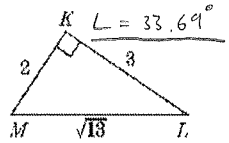


$\sin C = \frac{3}{\sqrt{15}}$

$C = 26.57^\circ$

d) $\sin L = \frac{2}{\sqrt{13}}$

$L = 33.69^\circ$

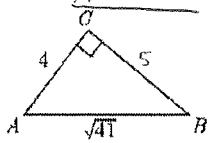


$\cos M = \frac{2}{\sqrt{13}}$

$= 56.31^\circ$

e) $\tan A = \frac{5}{4}$

$A = 51.34^\circ$

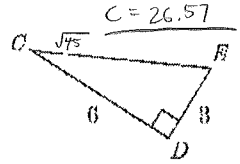


$\cos B = \frac{5}{\sqrt{41}}$

$B = 38.66^\circ$

f) $\cos C = \frac{6}{\sqrt{45}}$

$C = 26.57^\circ$

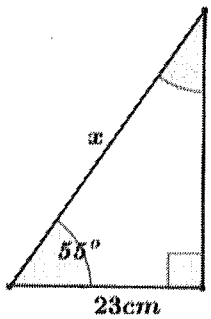


$\sin C = \frac{3}{\sqrt{15}}$

$C = 26.57^\circ$

10. Find the length of the missing sides for each of the following triangles:

a) x = ?

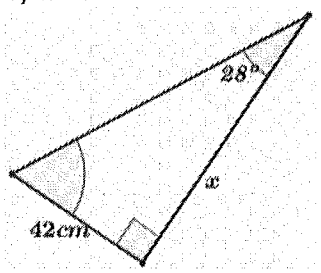


$\cos 55^\circ = \frac{23}{x}$

$x = 40.1$

$x = 40.1\text{cm}$

b) x = ?

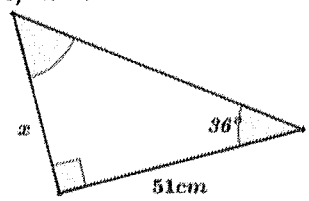


$\tan 28^\circ = \frac{42}{x}$

$x = 78.99$

$x = 78.99\text{cm}$

c) x = ?



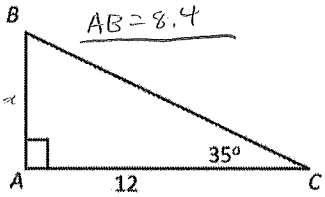
$\tan 36^\circ = \frac{x}{51}$

$x = 37.05$

$x = 37.05\text{cm}$

d) AB = ?

$AB = 8.4$



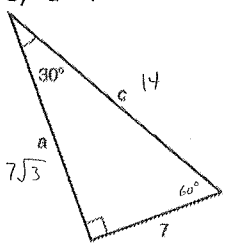
$\tan 35^\circ = \frac{x}{12}$

$x = 8.4$

BC = ?

$BC = 14.65$

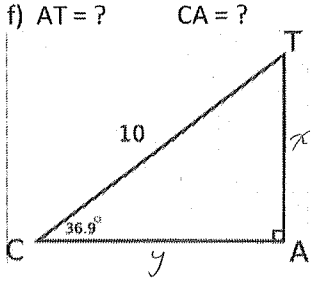
e) a = ? c = ?



$a = 7\sqrt{3}$ or 12.12

$c = 14$

f) AT = ? CA = ?



$\sin 36.9° = \frac{x}{10}$

$x = 6$

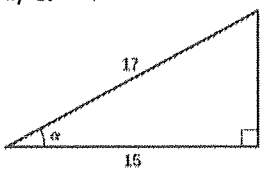
$\cos 36.9° = \frac{y}{10}$

$y = 8$

$\overline{AT} = 6$, $\overline{CA} = 8$

11. Find the degree of the missing angle accurate to 3 decimal places:

a) $\alpha = ?$

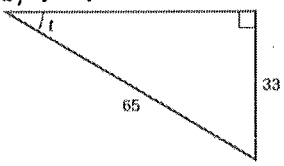


$\cos a = \frac{15}{17}$

$a = 28.072$

$28.072°$

b) $t = ?$

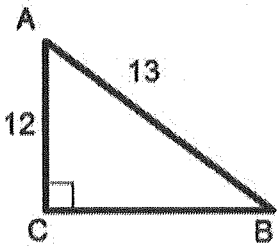


$\sin t = \frac{33}{65}$

$t = 30.51$

$30.51°$

c) $\angle B = ?$ $\angle A = ?$



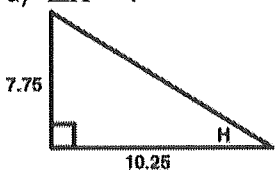
$\sin B = \frac{12}{13}$

$B = 67.38°$

$\cos A = \frac{12}{13}$

$A = 22.62°$

d) $\angle H = ?$

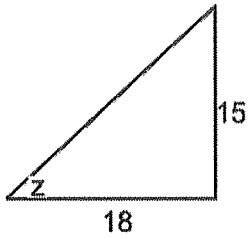


$\tan H = \frac{7.75}{10.25}$

$H = 37.093°$

$37.093°$

e) $\angle z = ?$

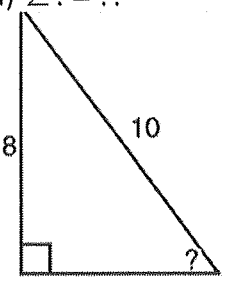


$\tan z = \frac{15}{18}$

$z = 39.806°$

$39.806°$

f) $\angle ? = ??$

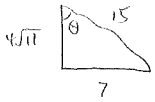


$\sin ? = \frac{8}{10}$

$? = 53.13°$

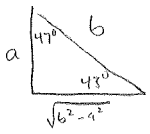
$53.13°$

12. In a right triangle, you are told that $\sin\theta = \frac{7}{15}$. What is the value of $\cos\theta$ and $\tan\theta$?



$\cos\theta = \frac{4\sqrt{11}}{15}$ $\tan\theta = \frac{7}{4\sqrt{11}}$

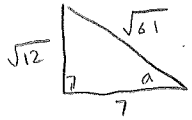
13. If $\sin 43° = \frac{a}{b}$, then what are the values of $\cos 47°$ and $\sin 47°$ in terms of "a" and "b"?



$\cos 47° = \frac{a}{b}$

$\sin 47° = \frac{\sqrt{b^2-a^2}}{b}$

14. Given that $0° < \alpha < 90°$, if $\tan\alpha = \frac{\sqrt{12}}{7}$ then what are the exact values of $\sin\alpha$ and $\cos\alpha$?



$\sin a = \frac{2\sqrt{183}}{61}$ $\cos a = \frac{7\sqrt{61}}{61}$

15. Indicate if the following work shown below is correct? If there is a mistake, please indicate it:

a) $step1 := \frac{\sin 12°}{6}$ $\frac{0.209}{6}$

$step2 := \cancel{\sin 2°}$

$step3 := \cancel{0.909297}$

0.035

b) $s1 := \cos 20° \times \sin 40°$

$s2 := \cancel{0.9 \times 0.64}$ 0.94×0.643

$s3 := 0.576$

0.604

c) $s1:\ \cos\frac{3}{4} = \theta$

$s2:\ 0.9999 = \theta$

✓

d) $s1: \tan(50°) = a$

$s2: \cancel{-0.2719006} = a$

1.192 = a

e) $s1: \sin(50+\theta) = \sin 40° + 0.8$

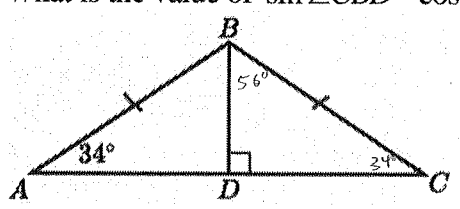
$s2: \cancel{50° + \theta = 40° + 0.8}$

$s3: \cancel{\theta = -9.2°}$

sin(50+θ) = 1.443

Impossible

16. What is the value of $\sin\angle CBD - \cos\angle BAC$?

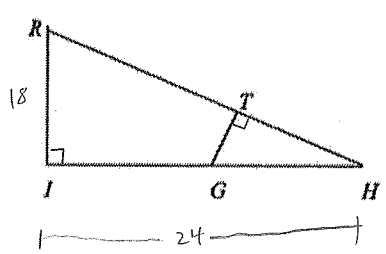


sin 56° − cos 34° = 0

0

17. In the diagram, point "G" is on the line segment HI, point "T" lies on the line segment RH, $\angle RIG$ and $\angle HTG$ are both $90°$. RI=18, HI = 24 and the lengths of RT, HT, and GT are integers. Find the sum of all possible distinct area of quadrilateral IGTR.

△IRH area = 216



△IRH ~ △TGH

TG : TH = 3 : 4

A=6 A=24 A=54

(3, 4), (6, 8), (9, 12),

(12, 16), (15, 20)

A=96 A=150

216×5−6−24−54−96−150

= 750

750

Name: Aiden Kim Date: ???

Math 10/11 Honors: Section 4.2 Radians and Angles in Standard Position

1. Convert the following angles to radians in terms of π. Show your work.

a) $60^\circ \times \frac{\pi}{180}$ $\frac{\pi}{3}$	b) $30^\circ \times \frac{\pi}{180}$ $\frac{\pi}{6}$	c) $150^\circ \times \frac{\pi}{180}$ $\frac{5\pi}{6}$	d) 210° $\frac{7\pi}{6}$
e) 90° $\frac{\pi}{2}$	f) 135° $\frac{3\pi}{4}$	g) 225° $\frac{5\pi}{4}$	h) 240° $\frac{4\pi}{3}$
i) 315° $\frac{7\pi}{4}$	j) 360° 2π	k) 330° $\frac{11\pi}{6}$	l) $1050^\circ \times \frac{\pi}{180}$ $\frac{35\pi}{6}$

2. Convert the following to the nearest degree. Show your work.

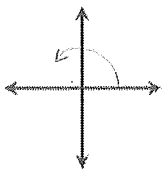
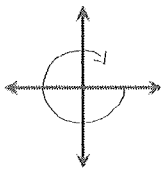
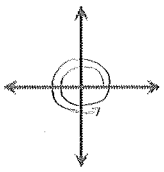
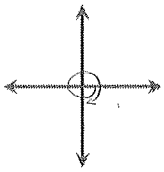
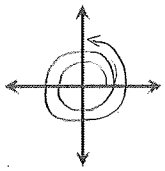
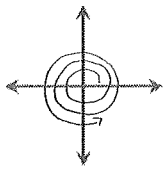
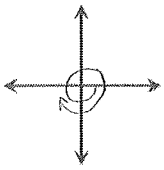
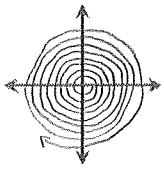
a) $\frac{2\pi}{3} \times \frac{180}{\pi}$ 120°	b) $\frac{2\pi}{6} \times \frac{180}{\pi}$ 60°	c) $\frac{2\pi}{4} \times \frac{180}{\pi}$ 90°	d) $\frac{5\pi}{3} \times \frac{180}{\pi}$ 300°
e) $\frac{16\pi}{12} \times \frac{180}{\pi}$ 240°	f) $\frac{11\pi}{3} \times \frac{180}{\pi}$ 660°	g) $\frac{7\pi}{6} \times \frac{180}{\pi}$ 210°	h) $\frac{15\pi}{4} \times \frac{180}{\pi}$ 675°
i) $\frac{\pi}{12} \times \frac{180}{\pi}$ 15°	j) $\frac{5\pi}{6} \times \frac{180}{\pi}$ 150°	k) $\frac{3\pi}{20} \times \frac{180}{\pi}$ 27°	l) $\frac{22\pi}{9} \times \frac{180}{\pi}$ 440°

3. Determine the arc length that subtends each angle at the center of the circle with radius 10cm.

$C = 20\pi$

a) 60° $\frac{1}{6} \times 20\pi$ $\frac{10}{3}\pi$	b) 150° $\frac{5}{12} \times 20\pi$ $\frac{25}{3}\pi$	c) 240° $\frac{2}{3} \times 20\pi$ $\frac{40}{3}\pi$
d) $\frac{\pi}{12} \times \frac{180}{\pi}$ $\frac{1}{24} \times 20\pi$ $\frac{5}{6}\pi$	e) $\frac{5\pi}{3} \times \frac{180}{\pi}$ $\frac{5}{6} \times 20\pi$ $\frac{50}{3}\pi$	f) $\frac{7\pi}{6} \times \frac{180}{\pi}$ $\frac{7}{12} \times 20\pi$ $\frac{35}{3}\pi$

4. Graph each angle in standard position. Find the reference angle.

a) $\frac{2\pi}{3} \times \frac{180}{\pi} = 120^\circ$ 	b) $-\frac{10\pi}{6} \times \frac{180}{\pi} = -300^\circ$ 	c) $\frac{15\pi}{4} \times \frac{180}{\pi} = 675^\circ$ 	d) $-\frac{7\pi}{3} \times \frac{180}{\pi} = -420$ 
e) 800° 	f) 1000° 	g) -500° 	h) -3000° 

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5. In what quadrants are the following angles in?

a) $35°$ 1st	b) $900°$ x-axis between 2nd and 3rd	c) $\frac{5\pi}{4} \times \frac{180}{\pi} = 225°$ 3rd	d) $\frac{22\pi}{3} \times \frac{180}{\pi} = 1320$ 3rd
e) $-475°$ 3rd	f) $-2590°$ 4th	g) $\frac{-9\pi}{5}$ 1st	h) $\frac{-17\pi}{4}$ 4th

6. Evaluate each of the following trigonometric functions without a calculator:

a) $\sin 60°$ $\frac{\sqrt{3}}{2}$	b) $\cos 90°$ 0	c) $\tan \frac{\pi}{2} \to 90°$ Undefined	d) $\cos \frac{\pi}{3} \to 60°$ $\frac{1}{2}$
e) $\sin 45°$ $\frac{\sqrt{2}}{2}$	f) $\tan 30°$ $\frac{\sqrt{3}}{3}$	g) $\sin \frac{\pi}{6} \to 30°$ $\frac{1}{2}$	h) $\tan 0°$ 0

7. What is the smallest positive coterminal angle of $2000°$?

$200°$

8. Give a general formula for all the coterminal angles of $-5200°$

$200° \pm 360x°$

9. Find the radius of a circle if an arc of 4cm subtends an angle of $30°$ on the circle.

$48cm = 2\pi r$

$r = \frac{24}{\pi}$ cm

10. What is the length of an arc subtended from the sector angle $\pi/5$ if the circle has a radius of 20cm?

$\frac{\pi}{5} \times \frac{120}{\pi} = 36°$

4π

11. What is the length of the radius of a circle with an arc length of 13.1 cm subtended from a sector of $42°$?

$\frac{7}{60} \times 2\pi r = 13.1$

$\frac{7\pi}{30} \times r = 13.1$

$r = 13.1 \times \frac{30}{7\pi}$

$= \frac{393}{7\pi}$

$\frac{393}{7\pi}$ cm

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12. As the time changes from 1:00pm to 3:45pm on a clock, determine the change in radians of the minute hand. Determine the change in radians for the hour hand.

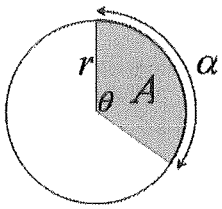
$990 \times \frac{\pi}{180} = \frac{11\pi}{2}$

$82.5 \times \frac{\pi}{180} = \frac{11\pi}{24}$

Minute hand $\frac{11\pi}{2}$

Hour hand $\frac{11\pi}{24}$

13. Derive a formula for the area, A, of a sector of a circle with radius "r", formed by an angle of θ radians. Derive a similar formula when the measure of the angle is in degrees



$\frac{\theta^R}{2\pi} = \frac{A}{\pi r^2}$ $\frac{\theta}{360^\circ} = \frac{A}{\pi r^2}$

14. If arc "a" is 6π cm long and the central $\theta = 72°$ then what is the area of the sector "A"?

$\frac{a}{2\pi r} = \frac{3}{r} = \frac{1}{5}$ $\frac{1}{5} = \frac{A}{225\pi}$

$r = 15$

$A = 45\pi$

15. Find the radius of a circle if an arc of 3 subtends an angle of $30°$ on the circle

$C = 36$

$2\pi r = 36$

$r = \frac{18}{\pi}$

$\frac{18}{\pi}$

16. Find the angle in degrees if an arc length of 5cm has a radius of 6cm.

$\frac{5}{12\pi} = \frac{\theta^R}{2\pi}$ $\frac{5}{6} \times \frac{12\pi}{\pi} = \frac{150}{\pi}$

$6\theta^R = 5$

$\theta^R = \frac{5}{6}$

$\left(\frac{150}{\pi}\right)^\circ$

17. When an object is moving in a circle, its "angular velocity" is the angle per unit time through which it rotates about the center. A car tire has diameter 64cm. Determine its angular velocity, in radians per second, when the car is travelling at 100km/h.

$\frac{4000}{3}$ m/min $\frac{25000}{9} \times \frac{1}{64\pi} = \frac{3125}{72\pi}$

$\frac{250}{9}$ m/sec

$\frac{3125}{36} \times 360 \times \frac{\pi}{180} = \frac{3125}{36}$

$\frac{25000}{9}$ cm/sec

$\frac{3125}{36}$ R/sec

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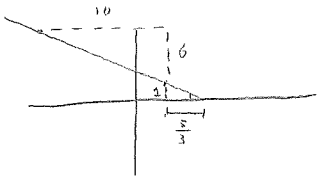
18. What is the smallest angle formed by the x-axis and the line through the points (2,1) and (-8,7)

$\tan\theta = \frac{1}{\frac{5}{3}} = \frac{3}{5}$

$\theta \approx 30.964$



30.964°

19. What is the sum of: $\sin^2(10°)+\sin^2(20°)+\sin^2(30°)+....+\sin^2(170°)$

a) 1 b) 3 c) 5 d) 9 e) 10

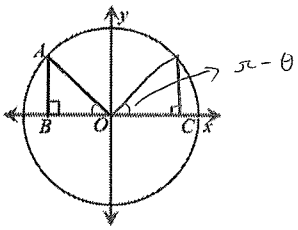
$10+80,\ 20+70,\ 30+60,\ 40+50$

$60+120,\ 110+150,\ 100+80,\ 80+100$ $\sin 90 = 1$

20. In the sequence below, each angle is in radians. What is the largest number of consecutive terms of this sequence that can be positive?

$$\underbrace{\cos x, \cos(x+1), \cos(x+2), \cos(x+3)}_{4}, \cos(x+4), \cos(x+5), \cos(x+6)$$

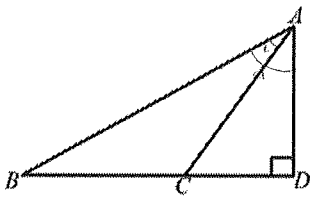
21. Use a geometric approach with an unit circle to show that for any obtuse angle θ, $\sin\theta = \sin(\pi-\theta)$



Exact same reference angle

22. Use the same approach above to show that for any obtuse angle θ, $\cos\theta = -\cos(\pi-\theta)$

23. Challenge: Use the figure below to prove that $\sin(a-b) = \sin a\cos b - \sin b\cos a$. Hint: Use the "Sine Law" if necessary.



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Name: Aiden Kim Date: ???

Math 10/11 Honors Section 4.3 Solving Angles in All Four Quadrants

1. If $\sin\theta$ is equal to a negative ratio, then which quadrants will the angle be? What if the ratio is positive, which quadrant is it in?

(negative) Quadrants 3 and 4

(positive) Quadrants 1 and 2

2. If $\cos\theta$ is equal to a negative ratio, then which quadrants will the angle be? What if the ratio is positive, which quadrant is it in?

(negative) Quadrants 2 and 3

(positive) Quadrants 1 and 4

3. If $\tan\theta$ is equal to a negative ratio, then which quadrants will the angle be? What if the ratio is positive, which quadrant is it in?

(negative) Quadrants 2 and 4

(positive) Quadrants 1 and 3

4. If θ is in quadrant 3, then which trig ratio will be negative? $\sin\theta$, $\cos\theta$, or $\tan\theta$?

sin θ and cos θ.

5. If θ is in quadrant 4, then which trig ratio will be negative? $\sin\theta$, $\cos\theta$, or $\tan\theta$?

sin θ and tan θ

6. Solve for θ, with $0 \le \theta \le 360°$. [REMEMBER: There are TWO answers!]

a) $\sin\theta = 0.8$ θ = 53.13° or 126.87° θ = 53.13° or 126.87°	b) $\cos\theta = 0.85$ θ = 31.79° or 328.21° θ = 31.79° or 328.21°	c) $\tan\theta = 0.3$ θ = 16.7° or 196.7° θ = 16.7° or 196.7°
a) $\sin\theta = -0.9$ θ = 244.16° or 295.84° θ = 244.16° or 295.84°	b) $\cos\theta = 0.125$ θ = 82.82° or 277.18° θ = 82.82° or 277.18°	c) $\tan\theta = 0.25$ θ = 14.04° or 194.04° θ = 14.04° or 194.04°

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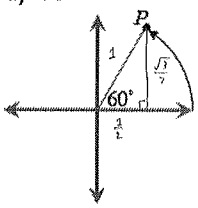
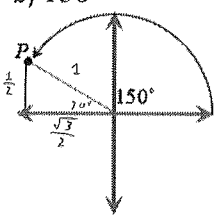
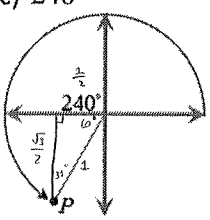
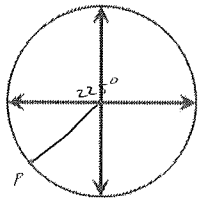
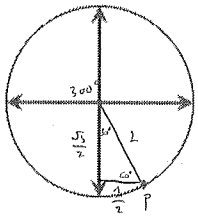
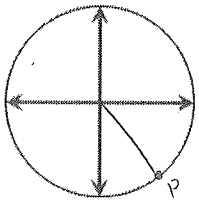
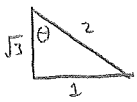
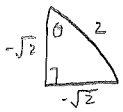
g) $3\sin\theta+5=0$ $\sin\theta=-\frac{5}{3}$ Impossible	h) $\tan^2\theta-5=0$ $\tan\theta=\sqrt{5}$ $\theta=65.91^\circ$ or 245.91° $\theta=65.91^\circ$ or 245.91°	i) $4\cos^2\theta-8=1$ $\cos\theta=\frac{3}{2}$ Impossible
j) $(\cos\theta+1)(3\sin\theta-2)=0$ $\cos\theta=-1$ $\quad$ $\sin\theta=\frac{2}{3}$ $\theta=180^\circ$ $\quad$ $\theta=41.81$ or 138.19 $\theta=41.81^\circ$ or 138.19° or 180°	k) $3\sin\theta=4\cos\theta$ $\frac{3\sin\theta}{4\cos\theta}=1$ $\frac{3}{4}\tan\theta=1$ $\tan\theta=\frac{4}{3}$ $\theta=53.13$ or 233.13 $\theta=53.13$ or 233.13	L) $\sin\theta=\cos\theta$ $\theta=45^\circ$ or 225° $\theta=45^\circ$ or 225°

7. A point ``P`` created by the endpoint of a terminal arm is on the circumference of an unit circle of radius 1. Given the angle in standard position, find the coordinates of point `P`.

a) 60°  $P:\left(\frac{1}{2},\frac{\sqrt{3}}{2}\right)$	b) 150°  $P:\left(-\frac{\sqrt{3}}{2},\frac{1}{2}\right)$	c) 240°  $P:\left(-\frac{1}{2},-\frac{\sqrt{3}}{2}\right)$
d) 225°  $P:\left(-\sqrt{\frac{1}{2}},-\sqrt{\frac{1}{2}}\right)$	e) 300°  $P:\left(\frac{1}{2},-\frac{\sqrt{3}}{2}\right)$	f) 315°  $P:\left(\sqrt{\frac{1}{2}},-\sqrt{\frac{1}{2}}\right)$

8. Given each trig ratio, find the specified trig ratio without using a calculator:

a) $\sin\theta=0.5$  $\cos\theta=\pm\frac{\sqrt{3}}{2}$ $\tan\theta=\pm\frac{\sqrt{3}}{3}$	b) $\cos\theta=\frac{-\sqrt{2}}{2}$  $\sin\theta=\pm\frac{\sqrt{2}}{2}$ $\tan\theta=\pm 1$	c) $\tan\theta=-\sqrt{3}$ $\cos\theta=\frac{1}{2}$ or $-\frac{1}{2}$ $\sin\theta=\frac{-\sqrt{3}}{2}$ $\quad$ $\frac{\sqrt{3}}{2}$

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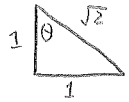
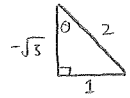
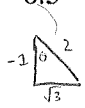
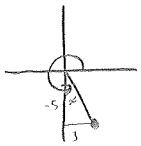
d) $\sin\theta = 1/\sqrt{2}$  $\cos\theta = \pm\frac{\sqrt{2}}{2}$ $\tan\theta = \pm 1$	e) $\cos\theta = \frac{-\sqrt{3}}{2}$  $\sin\theta = \pm\frac{1}{2}$ $\tan\theta = \pm\frac{\sqrt{3}}{3}$	f) $\tan\theta = \frac{1}{\sqrt{3}}$ $\cos\theta = \frac{\sqrt{3}}{2}$ or $-\frac{\sqrt{3}}{2}$ $\sin\theta = \frac{1}{2}$ $-\frac{1}{2}$
g) $\sin\theta = -1$ $\cos\theta = 0$ $\tan\theta =$ Undefined	h) $\cos\theta = -0.5$  $\sin\theta = \pm\frac{\sqrt{3}}{2}$ $\tan\theta = \pm\sqrt{3}$	i) $\tan\theta = -1$ $\cos\theta = \frac{-\sqrt{2}}{2}$ or $\frac{\sqrt{2}}{2}$ $\sin\theta = \frac{\sqrt{2}}{2}$ $\frac{-\sqrt{2}}{2}$

9. If the point P(3,-5) is on the terminal arm of an angle in standard position. What is the value of $\sin\theta \times \cos\theta$? Note: This point is not on the circumference of an unit circle.

$\tan x = \frac{3}{5}$



$\sin(60-45)^\circ = \sin 60^\circ \cos 45^\circ - \cos 60^\circ \sin 45^\circ$

$\sin 25^\circ = \frac{\sqrt{3}}{2} \times \frac{\sqrt{2}}{2} - \frac{1}{2} \times \frac{\sqrt{2}}{2}$

$= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4}$

$\sin 25^\circ = \frac{\sqrt{6}-\sqrt{2}}{4}$

10. Determine the following using exact value. No calculators:

a) $\cos\frac{5\pi}{4} \times \frac{180^\circ}{\pi} = \cos 225^\circ$ $-\frac{\sqrt{2}}{2}$	b) $\tan\frac{3\pi}{2} \times \frac{180^\circ}{\pi} = \tan 270^\circ$ Undefined	c) $\sin\frac{7\pi}{6} \times \frac{180^\circ}{\pi} = \sin 210^\circ$ $-\frac{1}{2}$
d) $\tan\frac{-3\pi}{4} \times \frac{180^\circ}{\pi} = \tan -135^\circ$ 1	e) $\cos\frac{11\pi}{6} \times \frac{180^\circ}{\pi} = \cos 330^\circ$ $\frac{\sqrt{3}}{2}$	f) $\sin\frac{8\pi}{3} \times \frac{180^\circ}{\pi} = \sin 480^\circ$ $\frac{\sqrt{3}}{2}$
g) $\tan 3\pi \times \frac{180}{\pi} = \tan 540$ 0	h) $\sin\frac{-5\pi}{3} \times \frac{180^\circ}{\pi} = \sin -300$ $\frac{\sqrt{3}}{2}$	i) $\cos\frac{3\pi}{3} \times \frac{180}{\pi} = \cos 180$ -1

11. The point $(-3,5)$ is on the terminal arm of angle θ in standard position. Find the angle in radians to one decimal place .

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12. A wheel with a radius of 1.5m is rotating at a angular velocity of 5.5radians per second. What is the speed of the wheel in m/s? $D = (3\pi)m$

$\left(\frac{990}{\pi}\right)^\circ$ per second

$3\pi \times \frac{11}{4\pi} = \frac{33}{4}$

$\frac{11}{4\pi}$ rotations per second

$\frac{33}{4}$ m/s

13. When an object is moving in a circle, its angular velocity is the angle per unit time through which it rotates about the center. A car tire has diameter 64cm. Determine its angular velocity, in radians per second, when the car is travelling at 100km/h.

Q17 in 4.2

10,000,000 cm/h

$\frac{25000}{9}$ cm/s

$\frac{3125}{36}$ R/sec

14. Write an expression for the angular velocity, in radians per second, for a car tire with diameter "d" centimeters when the car is travelling at "x" kilometers per hour.

$c = d\pi$

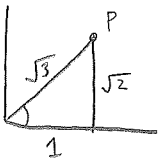
$\frac{250x}{9}$ /sec

$\frac{250x}{9d\pi} \times 2\pi = \frac{500x}{9d}$

$\frac{250x}{9} \div d\pi = \frac{250x}{9d\pi}$

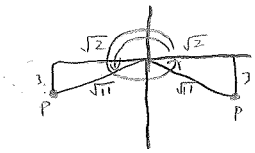
$\frac{500x}{9d}$ R / sec

15. The angle θ is in the first quadrant and $\cos\theta = \frac{1}{\sqrt{3}}$. Draw a diagram to show the angle in standard position and a point "P" on its terminal arm. Determine the possible coordinates for "P"



$(1, \sqrt{2})$

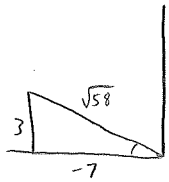
16. If $\sin\theta = -\frac{3}{\sqrt{11}}$, draw a diagram to show the angle(s) in standard position and a point "P" on its terminal arm. Determine the possible coordinates for "P" if it was on an unit circle.



P: $(-\sqrt{2}, -3)$, $(\sqrt{2}, -3)$

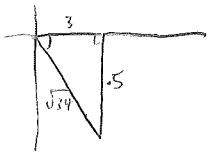
17. If $\tan\theta = -\frac{3}{\sqrt{7}}$, angle θ is in standard position, and its terminal arm is in quadrant II. What is the exact value of $\cos\theta$?

$-\frac{7\sqrt{58}}{58}$



18. Point P(3,-5) is on the terminal arm of an angle in standard position. What is the value of $\sin\theta \times \cos\theta$?

$\frac{-5}{\sqrt{34}} \times \frac{3}{\sqrt{34}} = -\frac{15}{34}$



$-\frac{15}{34}$

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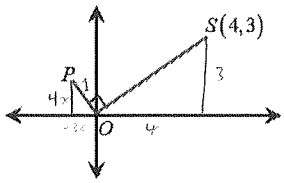
19. In the figure, if $\overline{PO}$ is one unit long, find the exact coordinates of point "P".



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

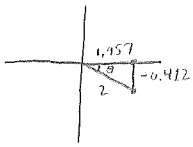
$25x^2=1$

$x^2=\frac{1}{25}$

$x=\frac{1}{5}$

$P: \left(-\frac{3}{5}, \frac{4}{5}\right)$

20. What is the value of $\sin\theta \times \tan\theta$ if point P(1.957, -0.412) is on a circle with a radius of 2units?



$-\frac{0.412}{2} \times -\frac{0.412}{1.957} = \frac{0.169744}{3.914}$

$\frac{0.169744}{3.914}$

21. Evaluate: $\sin\left(\frac{\pi}{12}\right)-\cos\left(\frac{\pi}{6}\right)+\tan\left(\frac{\pi}{4}\right)-\sin\left(\frac{\pi}{3}\right)-\cos\left(\frac{5\pi}{12}\right)$

$\sin(15^\circ)-\cos(30^\circ)+\tan(45^\circ)-\sin(60^\circ)-\cos(75^\circ)$

$=\frac{\sqrt{6}-\sqrt{2}}{4}-\frac{\sqrt{3}}{2}+1-\frac{\sqrt{3}}{2}-\frac{\sqrt{6}-\sqrt{2}}{4}$

$=1-\sqrt{3}$

$1-\sqrt{3}$

22. Find the exact value of $\sum_{k=1^\circ}^{360^\circ} \sin k$

$\sin 1^\circ + \sin 359^\circ = 0$

$\sin 2^\circ + \sin 358^\circ = 0$

$\vdots$

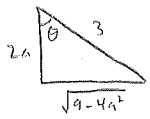
$\sin 179^\circ + \sin 181^\circ = 0$

$\sin 180^\circ = 0$

$\sin 360^\circ = 0$

0

23. If $\cos\theta = 2a/3$, then what is the value of $\tan\theta$ in terms "a"?



$\frac{\sqrt{9-4a^2}}{2a}$

24. If $\cos x = 0$ and $\cos(x+k)=0.5$, what is the smallest possible positive value of "k"?

$(\cos x)(\cos k)-(\sin x)(\sin k)=0.5$

$\sin k = \pm 0.5$

30°

25. If $K\cos\theta = 3$ and $K\sin\theta = 2$, where K>0, find the value of "R"

$\tan = \frac{\sin}{\cos}$

$\frac{K\sin\theta}{K\cos\theta} = \frac{2}{3}$

↳ Hehe

$\frac{\sin\theta}{\cos\theta} = \frac{2}{3}$

$K = 3.6056$

$\tan\theta = \frac{2}{3}$

$\theta = 33.69^\circ$

$K = 3.6056$

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26. If $A+B=180^\circ$, which of the following statements must be true?

i) $\sin A=\sin B$, ~~ii)~~ $\cos A=\cos B$ iii) $\tan A=-\tan B$

27. If $0\le\theta\le180^\circ$ and $\sin\theta\ge\cos\theta$, then what is the range of values for θ?

$45^\circ \le \theta \le 180^\circ$

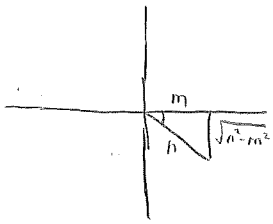
$\cos 270 \times \cos\theta + \sin 270 \times \sin\theta = -\sin\theta$

28. Which of the following is equal to $\cos(270^\circ-\theta)$? (No calculators)

i) $-\cos\theta$ ii) $\cos\theta$ iii) $-\sin\theta$ iv) $\sin\theta$

29. Determine the exact value of $\sin\theta$ in terms of "m" and "n" if $\cos\theta=\frac{m}{n}$, where θ is in quadrant 4.

$\sin\theta = -\frac{\sqrt{n^2-m^2}}{n}$



$-\frac{\sqrt{n^2-m^2}}{n}$

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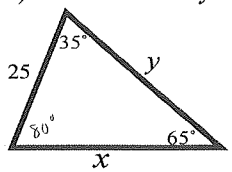
Name: Aiden Kim Date:_____

Math 10/11 Honors Section 4.4 Sine Law and Cosine Law

1. Indicate if you are to use the Sine Law or Cosine Law to find the missing side or angle. Then find the indicated side or angle. Show your work and steps:
2.

a) $x = 15.8218$ $y = 27.1654$

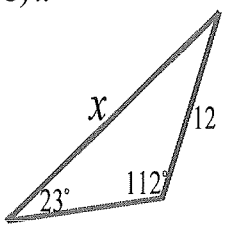


$\frac{25}{\sin 45} = \frac{x}{\sin 35}$ $\frac{25}{\sin 65} = \frac{y}{\sin 80}$

$x = 15.8218$ $y = 27.1654$

sin law

b) $x = 28.4754$

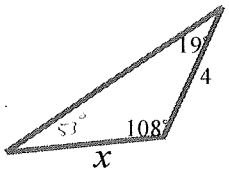


$\frac{12}{\sin 23} = \frac{x}{\sin 112}$

$x = 28.4754$

sin law

c) $x = 1.6306$

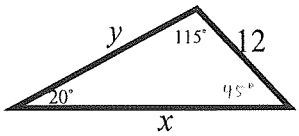


$\frac{4}{\sin 53} = \frac{x}{\sin 19}$

$x = 1.6306$

sin law

d) $x = 31.7984$ $y = 24.8093$

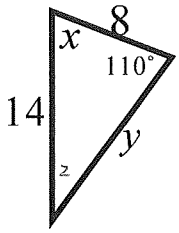


$\frac{12}{\sin 20} = \frac{x}{\sin 115}$ $\frac{12}{\sin 20} = \frac{y}{\sin 45}$

$x = 31.7984$ $y = 24.8093$

sin law

e) $x = 37.5226°$ $y = 9.0743$



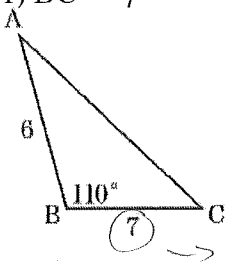
$\frac{\sin 110}{14} = \frac{\sin z}{8}$ $\frac{14}{\sin 110} = \frac{y}{\sin 37.5226°}$

$z = 32.4774°$

$x = 37.5226°$ $y = 9.0743$

sin law

f) BC = 7

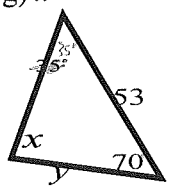


Probably supposed to be AC?

→ HAH

cos law

g) $x = 75°$ $y = 31.4719$

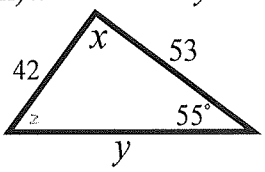


$\frac{53}{\sin 75} = \frac{y}{\sin 35}$

$y = 31.4719$

sin law

h) $x =$ $y =$



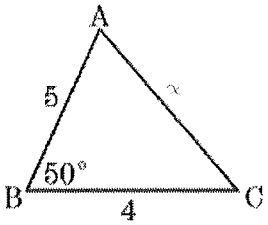
$\frac{\sin z}{53} = \frac{\sin 55}{42}$

$z =$ Impossible???

sin law

Undefined?

i) AC = 3.9101

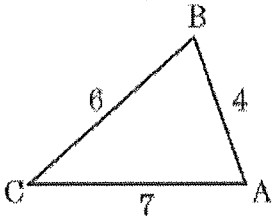


$x^2 = 25 + 16 - 40 \cos 50°$

$x = 3.9101$

cos law

j) $\angle B = 86.4167°$



$49 = 36 + 16 - 48 \cos x$

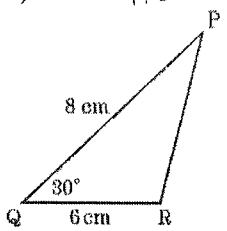
$48 \cos x = 3$

$\cos x = \frac{3}{48}$

$x = 86.4167°$

cos law

k) PR = 4.1063 cm

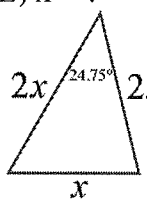


$x^2 = 100 - 96\cos 30$

$x = 4.1063$

cos law

L) x = ?



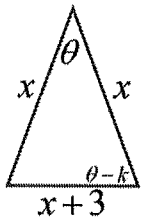
$x^2 = 4x^2 + 4x^2 + 12x + 9 - (8x^2 + 12x)\cos 24.75$

$(8x^2 + 12x)\cos 24.75° = 7x^2 + 12x + 9$

cos law

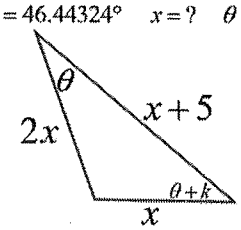
m)

$k = 31.6246°$ $x = ?$ $\theta = ?$



n)

$k = 46.44324°$ $x = ?$ $\theta = ?$

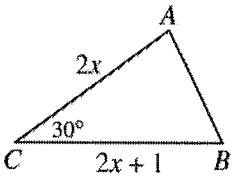


$x^2 = 4x^2 + x^2 + 10x + 25 - (4x^2 + 20x)(\cos\theta)$

$4x^2 + 10x + 25 = (4x^2 + 20x)(\cos\theta)$

$\cos\theta = \dfrac{4x^2 + 10x + 25}{4x^2 + 20x}$

3. In the diagram, $AC = 2x$, $BC = 2x + 1$ and $\angle ACB = 30°$. If the area of $\square ABC$ is 18, what is the value of "x"?



$\frac{1}{2} \times 2x \times (2x+1) \times \sin 30° = 18$

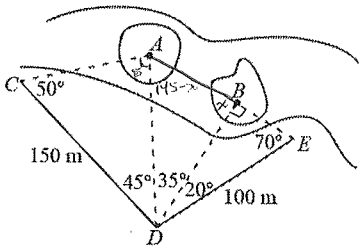
$2x^2 + x = 36$

$2x^2 + x - 36 = 0$

$x = \dfrac{-1 \pm \sqrt{1+288}}{4} = \dfrac{-1 \pm 17}{4} = 4$ or $-\frac{9}{2}$

4 or $\cancel{-\frac{9}{2}}$

4. In the diagram, points A and B are located on islands in a river full of rabid aquatic goats. Determine the distance from A to B, to the nearest meter.



$\dfrac{150}{\sin 85°} = \dfrac{AD}{\sin 50°}$

$\overline{AD} = 115.3456$

$\cos 20° = \dfrac{BD}{100}$

$\overline{BD} = 93.9693$

$AB^2 = 115.3456^2 + 93.9693^2 - 2(115.3456)(93.9693)\cos 35°$

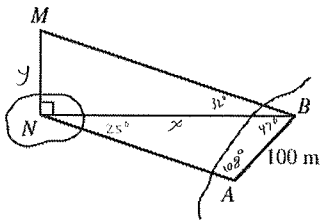
$= 22134.83678 - 17757.46838$

$= 4377.3484$

$AB \approx 66$

~66 m

5. In determining the height, MN, of a tower on an island, two points A and B, 100 meters apart, are chosen on the same horizontal plane as "N". If $\angle NAB = 108°$, $\angle ABN = 47°$, and $\angle MBN = 32°$, determine the height of the tower to the nearest meter.



$\dfrac{100}{\sin 25°} = \dfrac{x}{\sin 108°}$

$x = 225.0391$

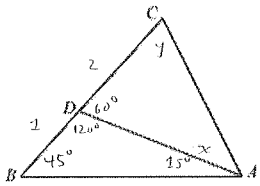
$\tan 32° = \dfrac{y}{225.0391}$

$y = 140.6201$

141 meters

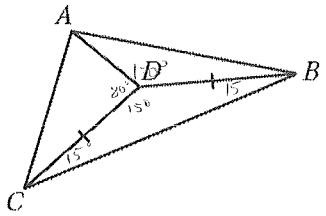
6. In triangle ABC, $\angle ABC = 45°$. Point "D" is on $\overline{BC}$ so that $2\square BD = CD$ and $\angle DAB = 15°$. Find $\angle ACB$.

a) 54° b) 60° c) 72° d) 75° e) 90°



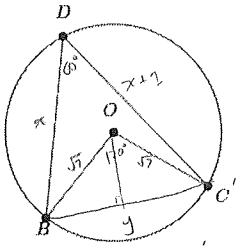
$\frac{\sin x}{\sin 15°} = \frac{\sin y}{\sin 45°} \times 2$

7. In the diagram, $DC = DB, \angle DCB = 15°$, and $\angle ADB = 130°$. What is the measure of $\angle ADC$?



$80°$

8. In the diagram, the circle has radius $\sqrt{7}$ and centre O. Points D, B, and C are on the circle. If $\angle BOC = 120°$ and $DC = DB + 1$, determine the length of DB.



$y^2 = 14 - 14\cos 120$

$y = \sqrt{21}$

$21 = x^2 + x^2 + 2x + 1 - (2x^2 + 2x)\cos 60°$

$x^2 + x = 2x^2 + 2x - 20$

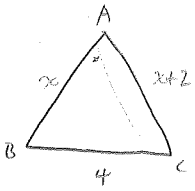
$0 = x^2 + x - 20$

$0 = (x-4)(x+5)$

$x = 4$

4

In $\square ABC, BC = 4, AB = x, AC = x + 2$, and $\cos(\angle BAC) = \frac{x+8}{2x+4}$. Determine all possible values of "x".



$16 = x^2 + x^2 + 4x + 4 - (2x^2 + 4x) \times \frac{x+8}{2x+4}$

$= 2x^2 + 4x + 4 - x^2 - 8x$

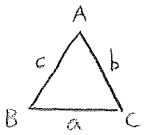
$16 = x^2 - 4x + 4$

$x^2 - 4x - 12 = 0$

$(x-6)(x+2) = 0$

$x = 6$

9. In $\square ABC$, $BC = a$, $AC = b$, $AB = c$, and $a < \frac{1}{2}(b + c)$. Prove that $\angle BAC < \frac{1}{2}(\angle ABC + \angle ACB)$



$2a < b + c$

$4a^2 < b^2 + 2bc + c^2$

$a^2 = b^2 + c^2 - 2bc(\cos A)$

$3a^2 < 2bc + 2bc(\cos A)$

$3a^2 < 2bc(\cos A + 1)$

$a^2 < \frac{2}{3}bc(\cos A + 1)$

$\angle A < \frac{1}{2}(180° - \angle A)$

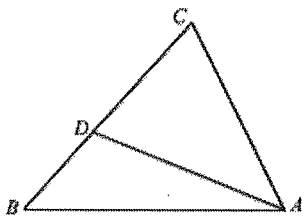
$\angle A < 90° - \frac{1}{2}\angle A$

$\angle A < 60°$

10. In triangle ABC, $\angle ABC = 45°$. Point "D" is on $\overline{BC}$ so that $2\square BD = CD$ and $\angle DAB = 15°$. Find $\angle ACB$

a) 54° b) 60° c) 72° d) 75° e) 90°

↳ On the third page as well



10. Challenge: In the diagram, $2\angle BAC = 3\angle ABC$ and "K" lies on BC such that $\angle KAC = 2\angle KAB$. Suppose that $BC = a$, $AC = b$, $AB = c$, $AK = d$, and $BK = x$ a) Prove that $d = \frac{bc}{a}$ and $x = \frac{a^2 - b^2}{a}$

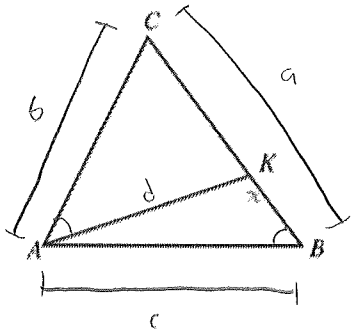
$x = \frac{(a+b)(a-b)}{a}$

$\angle ABC = \frac{2}{3}\angle BAC$

$\therefore \angle KAB = \frac{1}{3}\angle BAC$

$\angle KAC = \frac{2}{3}\angle BAC = \angle ABC$

$\frac{d}{\sin\ }$

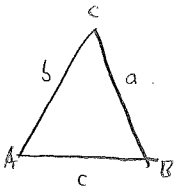


b) Prove that $(a^2 - b^2)(a^2 - b^2 + ac) = b^2c^2$

$a^2 = b^2 + c^2 - 2bc\cos A$

$a^2 - b^2 = c^2 - 2bc\cos A$

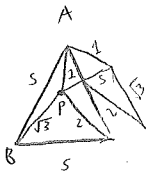
$(c^2 - 2bc\cos A)(c^2 - 2bc\cos A + ac) = b^2c^2$



11. Challenge:

Suppose that $\triangle ABC$ is an equilateral triangle of side length s, with the property that there is a unique point P inside the triangle such that $AP = 1$, $BP = \sqrt{3}$, and $CP = 2$. What is s?

(A) $1 + \sqrt{2}$ **(B)** $\sqrt{7}$ **(C)** $\frac{8}{3}$ **(D)** $\sqrt{5 + \sqrt{5}}$ **(E)** $2\sqrt{2}$



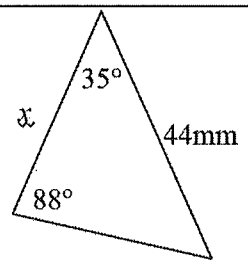
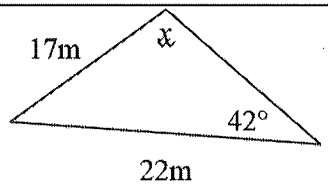
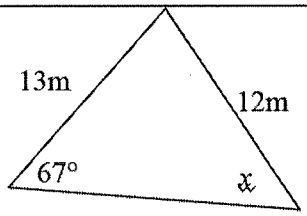
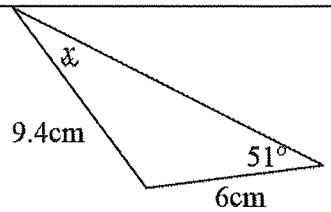
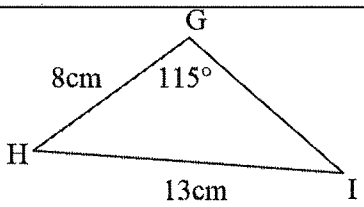
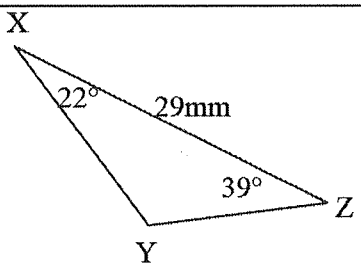
Name: Aiden Kim Date:_____

Math 10/11 Honours Section 4.5 Ambiguous Case of Sine Law

1. Given each equation, solve for all values of θ where $0 \le \theta \le 360^\circ$. Note: There are two angles!!

a) $\sin\theta = \frac{2}{3}$ $\theta = 41.81$ or 138.19 $\theta_1 =$ 41.81° $\theta_2 =$ 138.19°	b) $\sin\theta = \frac{4}{5}$ $\theta = 53.13$ or 126.87 $\theta_1 =$ 53.13° $\theta_2 =$ 126.87°	c) $\sin\theta = -0.55$ $\theta = 213.37^\circ$ or 326.63° $\theta_1 =$ 326.63° $\theta_2 =$ 213.37°
d) $\sin\theta = \frac{-\sqrt{2}}{2}$ $\theta_1 =$ 225° $\theta_2 =$ 315°	e) $\sin\theta = \frac{-\sqrt{3}}{2}$ $\theta_1 =$ 240° $\theta_2 =$ 300°	f) $\sin\theta = \frac{4}{\sqrt{7}}$ Undefined $\theta_1 =$ ____ $\theta_2 =$ ____

2. Given each of the following triangles, indicate whether if there would be an ambiguous case. State the reason why or why not:

 No, we have all angles	 Yes, the 17m side can swing (ASS)	 Yes, 12 cm side can swing (ASS)
 No, 9.4cm is longer than 6cm (can't swing)	 No, 13cm is longer than 8cm (can't swing)	 No, we have all angles

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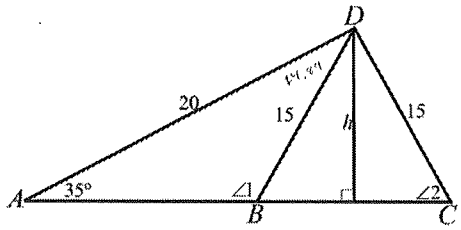
3. Given each triangle, find the missing values and show all your work

Find the value of $\angle 1$, $\angle 2$, h, BC, *and* AB



$\frac{\sin 35^\circ}{15} = \frac{\sin \angle 1}{20}$

$\angle 1 = 49.89$ or 130.11 ✓

$\sin 49.89^\circ = \frac{h}{15}$

$h = 11.47$

$\frac{AB}{\sin 49.89^\circ} = \frac{15}{\sin 35^\circ}$

$AB = 6.72$

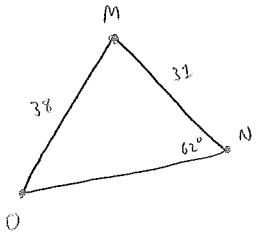
$\cos 49.89^\circ = \frac{\frac{1}{2}BC}{15}$

$\frac{1}{2}BC = 9.66$

$BC = 19.32$

$\angle 1 =$ 130.11° $\angle 2 =$ 49.89° $h =$ 11.47 $BC =$ 19.32 $AB =$ 6.72

4. Given that length MN is 31m, MO is 38m and angle MNO is 62degrees. Draw a diagram for triangle MON and then find the value of $\angle MON$, $\angle OMN$, *and* $\overline{ON}$



$\frac{\sin 62}{38} = \frac{\sin O}{31}$

$\angle O = 46.08$

$\angle M = 71.92$

$\frac{38}{\sin 62} = \frac{ON}{\sin 71.92}$

$ON = 40.91$

$\angle MON =$ 46.08° (ACUTE) $\angle OMN =$ 71.92° $ON =$ 40.91

Not ambiguous???

$\angle MON =$ _____ (OBTUSE) $\angle OMN =$ _____ $ON =$ _____

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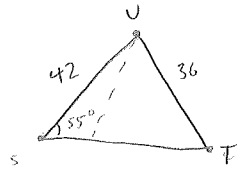
e) Triangle STU has side TU = 36, US = 42, and angle UST = 55degrees. Draw a diagram for the triangle and consider all cases. Find the length and angles below:



$\frac{\sin 55^\circ}{36} = \frac{\sin T}{42}$

$T = 72.88^\circ$ or 107.12°

$U = 52.12^\circ$ or 17.88°

$\frac{36}{\sin 55^\circ} = \frac{ST}{\sin 52.12^\circ}$

$ST = 34.69$

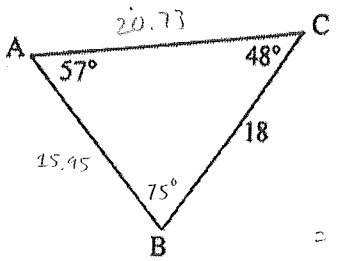
$\frac{36}{\sin 55^\circ} = \frac{ST}{\sin 17.88^\circ}$

$ST = 13.49$

$\angle STU =$ 72.88° (ACUTE) $\angle U$ ~~ST~~ = 52.12° $ST =$ 34.69

$\angle STU =$ 107.12° (OBTUSE) $\angle U$ ~~ST~~ = 17.88° $ST =$ 13.49

5. Find the area of the following triangle.



$\frac{18}{\sin 57^\circ} = \frac{b}{\sin 75^\circ}$

$b = 20.73$

$\frac{18}{\sin 57^\circ} = \frac{c}{\sin 48^\circ}$

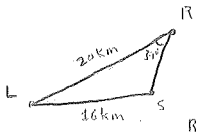
$c = 15.95$

$\sqrt{27.34(9.34)(6.61)(11.39)}$

$= 138.65$

138.65 units²

6. A lighthouse at point Q is 20 km from a yacht at point R and 16 km from a sailboat at point S. From the yacht, the lighthouse and the sailboat are separated by an angle of 39°

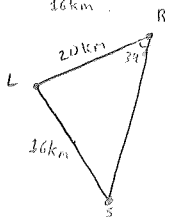


a) Is it necessary to consider the ambiguous case? Explain.

Yes because then we might not know which direction the sailboat is coming from

b) Sketch all possible diagrams for this situation.

There V go



c) Determine all possible the distances from the yacht to the sailboat, to the nearest tenth of a kilometre.

$\frac{\sin 39}{16} = \frac{\sin S}{20}$

$S = 51.87^\circ$ or 128.13°

$\frac{16}{\sin 39^\circ} = \frac{x}{\sin 89.13^\circ}$

$x = 25.4$

$\frac{16}{\sin 39^\circ} = \frac{x}{\sin 12.87^\circ}$

$x = 5.7$

5.7km or 25.4km

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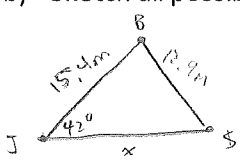
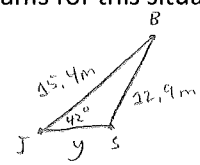
7. Jason and Sammy are part of a scientific team studying clouds. The team is about to launch a weather balloon into an active part of the cloud. Jason's rope is 15.4 m long and makes an angle of $42°$ with the ground. ~~Belle~~'s rope is 12.9 m long.
Sammy

a) Is it necessary to consider the ambiguous case? Explain.

Yes because the distance between Jason and Sammy is undetermined.

b) Sketch all possible diagrams for this situation.





c) Determine all possible the distances between Jason and Sammy to the nearest tenth of a meter.

$\frac{\sin 42°}{12.9} = \frac{\sin S}{15.4}$

$S = 53.02°$ or $126.98°$

$B = 84.98°$ or $11.02°$

$\frac{12.9}{\sin 42°} = \frac{x}{\sin 84.98°}$

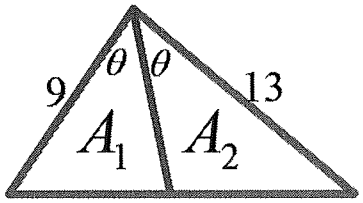
$x = 19.2$

$\frac{12.9}{\sin 42°} = \frac{y}{\sin 11.02°}$

$y = 3.7$

3.7m or 19.2m

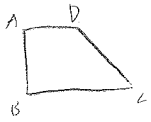
8. Given the following triangle with an area of 200units^2, what is the area of A_1 and A_2 ?



$81 : 169 = \frac{324}{5} : \frac{676}{5}$

$A_1 = \frac{324}{5}$ units^2 $A_2 = \frac{676}{5}$ units^2

9. Trapezoid ABCD has $AD \square BC$, $BD = 1$, $\angle DBA = 23°$ and $\angle BDC = 46°$. The ratio of $BC : AD$ is $9:5$. What is the length of CD? (AMC12)



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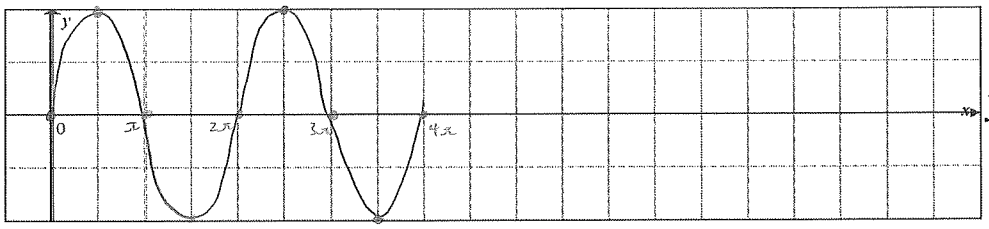
name: Aiden Kim Date: ???

Section 4.6 Graphing Sine Cosine and Tangent Functions

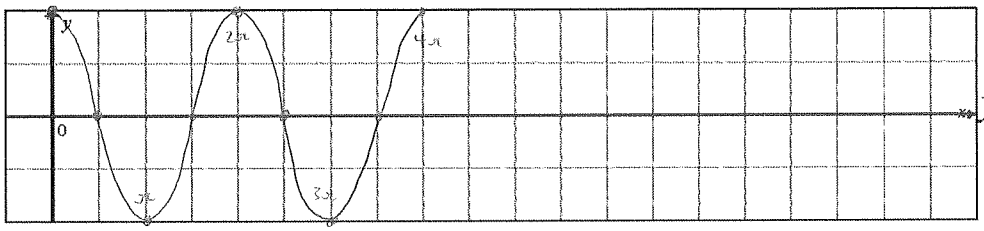
1. Graph two periods of the Sine / Cosine / and Tangent function from $0 \le \theta \le 4\pi$. Label and set the increments on the X/Y-axis, write a general formula for all the x-intercepts, vertical asymptotes (if any). Indicate the period, amplitude, domain, and range of each graph.



$y = \sin\theta$

$x = n\pi$

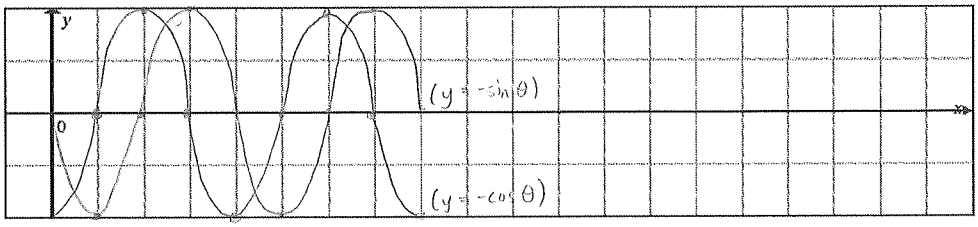
Period: 2π
Amplitude: 1
Domain: $x \in \mathbb{R}$
Range: $-1 \le y \le 1$



$y = \cos\theta$

$x = \frac{\pi}{2} + n\pi$

Period: 2π
Amplitude: 1
Domain: $x \in \mathbb{R}$
Range: $-1 \le y \le 1$



$y = -\sin\theta$

$x = n\pi$

$y = -\cos\theta$

$x = \frac{\pi}{2} + n\pi$

Period: 2π
Amplitude: 1
Domain: $x \in \mathbb{R}$
Range: $-1 \le y \le 1$

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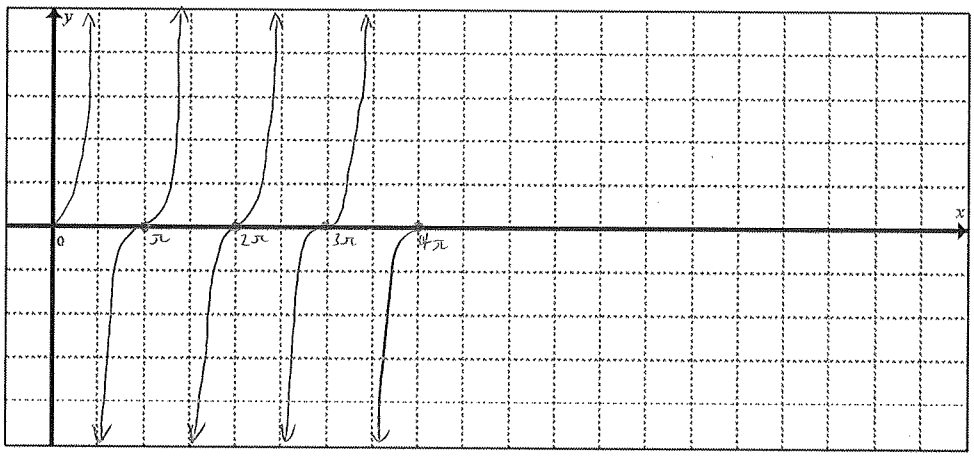
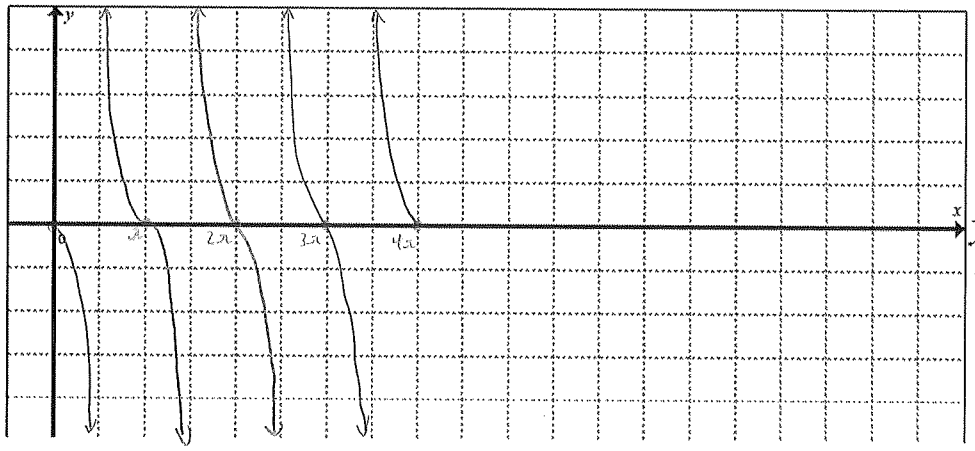


$y = \tan\theta$

$x = n\pi$

Period: π
Amplitude: Infinite
Domain: $x \in \mathbb{R}$; $x \neq \frac{1}{2}\pi \pm n\pi$
Range: $y \in \mathbb{R}$

Asymptotes: $x = \frac{\pi}{2} + n\pi$



$y = -\tan\theta$

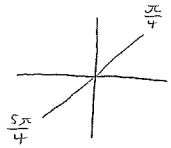
$x = n\pi$

Period: π
Amplitude: Infinite
Domain: $x \in \mathbb{R}$; $x \neq \frac{1}{2}\pi \pm n\pi$
Range: $y \in \mathbb{R}$

Asymptotes: $x = \frac{\pi}{2} + n\pi$

2. When the graph of $y = \sin x$ and $y = \cos x$ are drawn on the same graph for $0 < x < 2\pi$ in which quadrants do they intersect? What are the coordinates of the points of intersection?

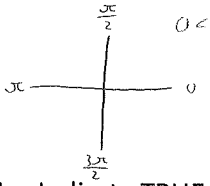
Intersect at $\frac{\pi}{4}$ and $\frac{5\pi}{4}$



Quadrants 1 and 3. $\left(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}\right)$ and $\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

3. Given that $\sin\theta > 0$ and $\cos\theta < 0$, what is the range of possible values of θ if $0 < \theta < 2\pi$?

$0 < \theta < \pi$ $\quad \frac{\pi}{2} < \theta < \frac{3\pi}{2}$



$\frac{\pi}{2} < \theta < \pi$

4. Indicate TRUE or FALSE: $\sin\theta > 0$ and $\cos\theta > 0$, then $\tan\theta$ can be either positive or negative.

$\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\quad$ Positive / Positive = Positive

False, tan θ can only be positive.

5. Given each of the following trigonometric graphs, indicate the amplitude and period

↓

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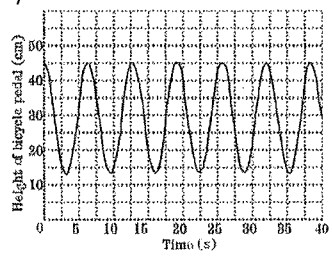
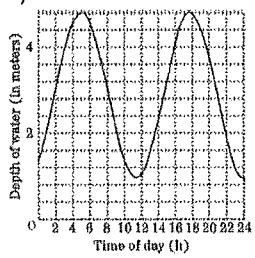
a)



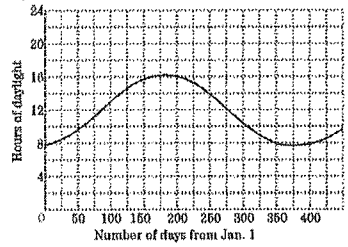
Period= 6.25 Amplitude= 15

b)



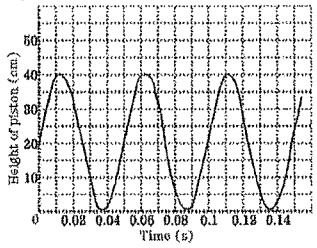
Period= 13 Amplitude= 1.9

c)



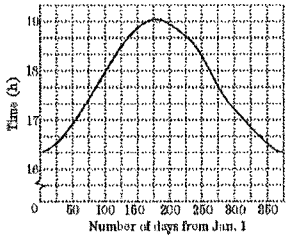
Period= 375 Amplitude= 4

d)



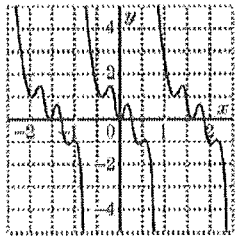
Period= 0.05 Amplitude= 20

e)



Period= 375 Amplitude= $\frac{4}{3}$

f)



Period= $\frac{3}{2}$ Amplitude= Infinite

6. How do the intersections of $y = \sin x$ and $y = \cos x$ relate with the graph of $y = \tan x$?

$\sin x = \cos x$

$\frac{\sin x}{\cos x} = \frac{\cos x}{\cos x}$

$\tan x = 1$

The intersection points of $\sin x$ and $\cos x$ indicate where $\tan x$ is equal to 1.

7. How many units should the graph of $y = \sin x$ be shifted horizontally so that it will overlap the graph of $y = \cos x$?

$\frac{\pi}{2}$ units to the left or $\frac{3\pi}{2}$ units to the right.

8. When the graph of $y = \sin x$ and $y = 0.5$ are drawn on the same graph for $0 < x < 2\pi$ in which quadrants do they intersect? What are the coordinates of the points of intersection?

$\sin x = 0.5$ (which is positive)

$x = \frac{\pi}{6}$ or $\frac{5\pi}{6}$

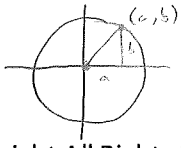
Quadrants 1 and 2. $(\frac{\pi}{6}, 0.5)$ and $(\frac{5\pi}{6}, 0.5)$

9. What is the amplitude and period of the graph $y = A\sin(Bx)$ if $A = -3$ and $B = 2$?

$1 \times 3 = 3$ $2x \div 2 = \pi$

Amplitude: 3 Period: π

10. Given that the terminal arm intersects the unit circle at coordinates (a,b), what is the reference angle and the angle in standard position?



$\theta = \tan^{-1}\left(\frac{b}{a}\right)$

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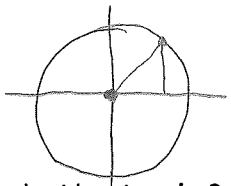
11. If point "P" is on the unit circle with coordinates defined by $(\sin\theta, \cos\theta)$, what is θ in standard position?



$\sin\theta = \cos\theta$

$\theta = 45°$ or $225°$

$\theta = 45°$ or $225°$

12. Given the identity $\sin 2a = 2\sin a \times \cos a$, what is the value of $\sin 2d$ if $\cos d = \frac{3}{4}$ and "d" is in quadrant 1?

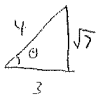
Find the exact value.

$\sin 2d = 2\sin d \times \frac{3}{4}$

$= \frac{3}{2}\sin d$

$\cos d = \frac{3}{4}$

$\sin d = \frac{\sqrt{7}}{4}$



$\sin 2d = \frac{3\sqrt{7}}{8}$

$d = 41.4096°$ or $\left(\sin^{-1}\left(\frac{3\sqrt{7}}{8}\right) \div 2\right)°$

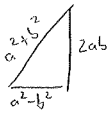
$2d = 82.8192$

$d = 41.4096$

13. If $\cos\theta = \dfrac{a^2 - b^2}{a^2 + b^2}$ and $0° \le \theta \le 90°$, find the value of $\sin\theta$:

$a^4 + 2a^2b^2 + b^4 - a^4 + 2a^2b^2 - b^4 = 4a^2b^2$

a) $\dfrac{2ab}{a^2+b^2}$ b) $\dfrac{4ab}{a^2+b^2}$ c) $\dfrac{2a^2b^2}{a^2+b^2}$ d) $\dfrac{4a^2b^2}{a^2+b^2}$ e) $\dfrac{a^2b^2}{2a^2+2b^2}$



14. If $0° \le \theta \le 180°$ and $\sin\theta \ge \cos\theta$, then:

a) $0 \le \theta \le 45°$ b) $45° \le \theta \le 90°$ c) $45° \le \theta \le 180°$ d) $90° \le \theta \le 180°$ e) $0 \le \theta \le 90°$

$\sin 45° = \cos 45°$

15. $\cos(270° - \theta) = (\cos 270)(\cos\theta) + (\sin 270)(\sin\theta)$

$= -\sin\theta$

a) $-\cos\theta$ b) $\cos\theta$ c) $-\sin\theta$ d) $\sin\theta$ e) $\sin\theta\cos\theta$

16. If $\sin 2a < 0$, $\cos a - \sin a < 0$, which quadrant is angle a in?

a) I b) II c) III d) IV

17. In ΔABC, $2\cos B\cos A = \sin C$. What kind of shape is the triangle?

a) Right triangle b) Equilateral triangle c) 45-45-90 triangle d) Isosceles triangle

↳ Technically?

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$2\cos^2 45° = 1$

18. $0 < \beta < 2\pi$ what does β need to be in order for $\sin\beta > \cos\beta$ to be true?

A. $\frac{\pi}{4} < \beta < \frac{\pi}{2}$ and $\pi < \beta < \frac{5}{4}\pi$

B. $\frac{\pi}{4} < \beta < \pi$

C. $\frac{\pi}{4} < \beta < \frac{5}{4}\pi$

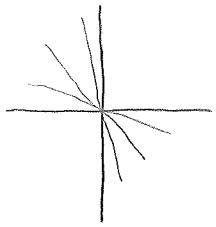
D. $\frac{\pi}{4} < \beta < \pi$ *and* $\frac{5}{4}\pi < \beta < \frac{3}{2}\pi$

$225^\circ > \beta > 45^\circ$

sin and cos equal sin and cos equal

19. Angle A, B are both acute angles. Point P has coordinates (cosB-sinA, sinB-cosA) Which quadrant is point P in?

a) I b) II c) III d) IV



A > B or B > A

Always either quadrant 2 or 4

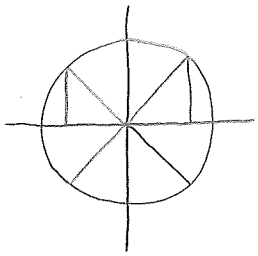
20. sinα>sinβ Which of the following is true?

a) If α,β are in the quadrant I, then cosα>cosβa

b) If α,β are in the quadrant II, then tanα>tanβ

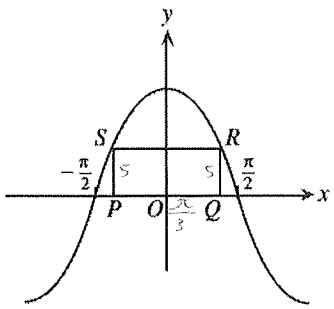
c) If α,β are in the quadrant III, then cosα>cosβ

d) If α,β are in the quadrant IV, then tanα>tanβ



Picking random numbers each time haha

21. A rectangle PQRS has side PQ on the x-axis and touches the graph of $y = k\cos(x)$ at the point "S" and "R" as shown. If the length of PQ is $\frac{\pi}{3}$ and the area of the rectangle is $\frac{5\pi}{3}$, what is the value of "k"?



$\frac{5\pi}{3} \times \frac{3}{\pi} = 5$

$R = \left(\frac{\pi}{6}, 5\right)$

$5 = k\cos\frac{\pi}{6}$

$k = \frac{5}{\cos\frac{\pi}{6}}$

$= \frac{5}{\cos 30^\circ}$

$= \frac{10\sqrt{3}}{3}$

$k = \frac{10\sqrt{3}}{3}$

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Name: Aiden Kim Date: ???

Math 10/11 Honors: Section 4.7 Cosecant Secant and Cotangent Functions

1. Determine each value to 3 decimal places:

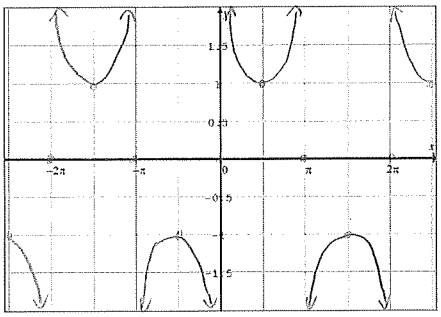
a) $\csc 110°$ $\frac{1}{\sin 110°}$ 1.064	b) $\cot 130°$ $\frac{1}{\tan 130}$ -0.839	c) $\sec 95°$ $\frac{1}{\cos 95}$ -11.474	d) $\csc 64°$ $\frac{1}{\sin 64°}$ 1.113
e) $\cot 233°$ $\frac{1}{\tan 233}$ 0.754	f) $\sec 100°$ $\frac{1}{\cos 100}$ -5.759	g) $\cot 45°$ $\frac{1}{\tan 45}$ 1	h) $\sec 112°$ $\frac{1}{\cos 112}$ -2.669

2. Determine the exact value of each of the following without a calculator

a) $\csc 45°$ $\frac{1}{\sin 45}$ $\sqrt{2}$	b) $\cot 180°$ $\frac{1}{\tan 180}$ Undefined	c) $\sec 60°$ $\frac{1}{\cos 60}$ 2	d) $\csc 135°$ $\frac{1}{\sin 135}$ $\sqrt{2}$
e) $\cot \frac{\pi}{3} \times \frac{180}{\pi}$ $\frac{1}{\cos 60}$ 2	f) $\sec \frac{2\pi}{3} \times \frac{180}{\pi}$ $\frac{1}{\cos 120}$ -2	g) $\cot 225°$ $\frac{1}{\tan 225}$ 1	h) $\csc 300°$ $\frac{1}{\sin 300}$ $-\frac{2\sqrt{3}}{3}$
i) $\sec \frac{11\pi}{6} \times \frac{180}{\pi}$ $\frac{1}{\cos 330}$ $\frac{2\sqrt{3}}{3}$	j) $\cot \frac{4\pi}{3} \times \frac{180}{\pi}$ $\frac{1}{\tan 240}$ $\frac{\sqrt{3}}{3}$	k) $\csc \pi$ $\frac{1}{\sin 180}$ Undefined	L) $\sec \frac{5\pi}{6} \times \frac{180}{\pi}$ $\frac{1}{\cos 150}$ $-\frac{2\sqrt{3}}{3}$

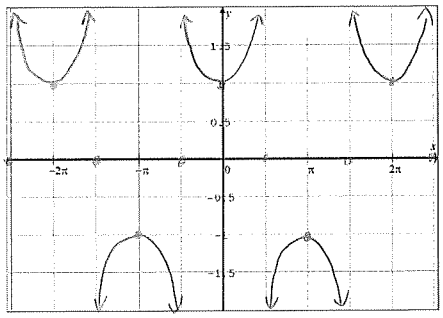
3. Graph the following function for $-2\pi \le \theta \le 2\pi$. Indicate the Period, Amplitude, Domain, and Range:

i) $y = \csc x$



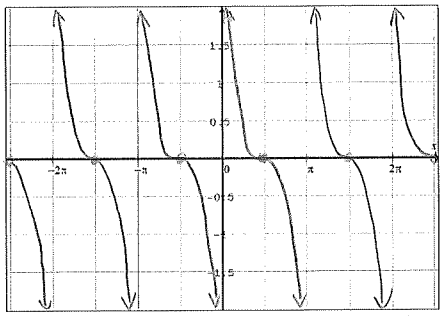
Period: π Amplitude: Infinite
Domain: $x \in \mathbb{R}, x \neq n\pi$ Range: $y \le -1,\ y \ge 1$

ii) $y = \sec x$



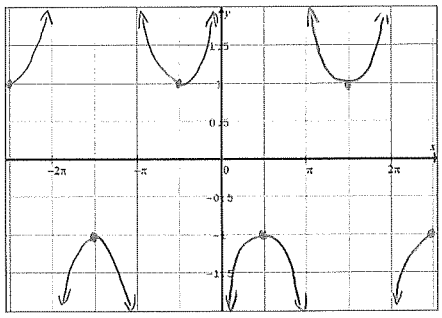
Period: π Amplitude: Infinite
Domain: $x \in \mathbb{R}, x \neq \frac{(2n+1)\pi}{2}$ Range: $y \le -1,\ y \ge 1$

iii) $y = \cot x$



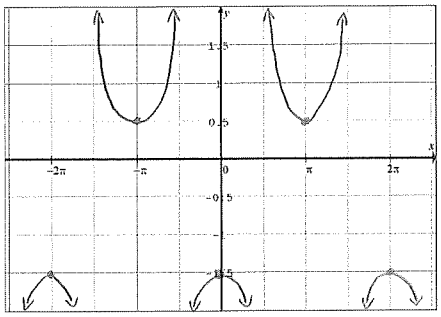
Period: π Amplitude: Infinite
Domain: $x \in \mathbb{R}, x \neq n\pi$ Range: $y \in \mathbb{R}$

iv) $y = -\csc x$



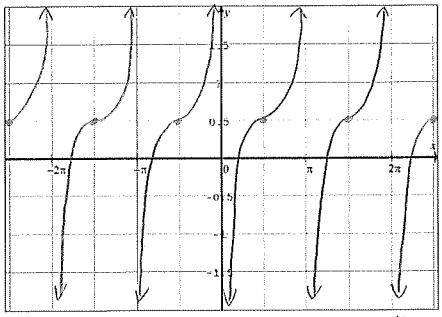
Period: π Amplitude: Infinite
Domain: $x \in \mathbb{R}, x \neq n\pi$ Range: $y \le -1,\ y \ge 1$

v) $y = -\sec x - 0.5$



Period: π Amplitude: Infinite
Domain: $x \in \mathbb{R}, x \neq \frac{(2n+1)\pi}{2}$ Range: $y \le -1.5,\ y \ge 0.5$

vi) $y = -\cot x + 0.5$



Period: π Amplitude: Infinite
Domain: $x \in \mathbb{R}, x \neq n\pi$ Range: $y \in \mathbb{R}$

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$\sin^2 x + \cos^2 x = 1$

14. Simplify the following in terms of "sine" and "cosine" only:

a) $(\sec x \csc x - \cot x)(\sin x - \csc x)$ $= \left(\frac{1}{\sin x \cos x} - \frac{\cos x}{\sin x}\right)\left(\sin x - \frac{1}{\sin x}\right)$ $= \left(\frac{1-\cos^2 x}{\sin x \cos x}\right)\left(\frac{\sin^2 x - 1}{\sin x}\right)$ $= \left(\frac{\cancel{\sin^2 x}}{\cos x}\right)\left(-\frac{\cancel{\cos^2 x}^{\cos x}}{\cancel{\sin x}}\right)$ $= -\cos x$ $\underline{-\cos x}$	b) $\dfrac{\dfrac{\cot x + 1}{\cot x} - 1}{\dfrac{\cot x - 1}{\cot x} - 1} = \frac{1}{\cot x} \div \frac{-1}{\cot x} = -1$ $\underline{-1}$
c) $\cot x + \tan x$ $= \frac{\cos x}{\sin x} + \frac{\sin x}{\cos x}$ $= \frac{\cos^2 x + \sin^2 x}{\sin x \cos x}$ $= \frac{1}{\sin x \cos x}$ $\underline{\frac{1}{\sin x \cos x}}$	d) $\dfrac{\csc^2 x + \sec^2 x}{\csc x \sec x} = \dfrac{\frac{1}{\sin^2 x} + \frac{1}{\cos^2 x}}{\frac{1}{\sin x \cos x}} = \dfrac{\frac{\cos^2 x + \sin^2 x}{\sin^2 x \cos^2 x}}{\frac{1}{\sin x \cos x}} = \frac{1}{\sin x \cos x}$ $\underline{\frac{1}{\sin x \cos x}}$
e) $\sec A\sqrt{\dfrac{1-\sin^2 B \sin^2 A}{1+\cos^2 A \tan^2 B}} = \frac{1}{\cos A}\sqrt{\dfrac{1-\sin^2 A \sin^2 B}{1+\cos^2 A \times \frac{\sin^2 B}{\cos^2 B}}}$ $= \frac{1}{\cos A}\sqrt{\dfrac{1-\sin^2 A \sin^2 B}{\frac{\cos^2 B + \cos^2 A \sin^2 B}{\cos^2 B}}}$ $\underline{\frac{\cos^2 B + \cos^2 A \sin^2 B}{\cos^2 B}}$	f) $\dfrac{\sec x}{\tan x + \cot x} = \frac{1}{\cos x} \div \frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}$ $= \frac{1}{\cancel{\cos x}} \times \sin x \cancel{\cos x}$ $= \sin x$ $\underline{\sin x}$

4. Indicate the general formula for the vertical asymptotes of $y = \cot x$

$\underline{x \neq n\pi}$

5. Given each expression, calculate the value of θ for $0 < \theta < 2\pi$

a) $\csc\theta = -2$ $\sin\theta = -\frac{1}{2}$ $\underline{\theta = 210^\circ \text{ or } 330^\circ}$	b) $\sec\theta = \dfrac{2\sqrt{3}}{3}$ $\cos\theta = \frac{3}{2\sqrt{3}} = \frac{\sqrt{3}}{2}$ $\underline{\theta = 30^\circ \text{ or } 330^\circ}$	c) $\cot^2\theta = 1$ $\tan^2\theta = 1$ $\tan\theta = -1 \text{ or } 1$ $\underline{\theta = 45^\circ, 135^\circ, 225^\circ, 315^\circ}$	d) $3\csc\theta = -2\sqrt{3}$ $\sin\theta = \frac{-\sqrt{3}}{2}$ $\underline{\theta = 240^\circ \text{ or } 300^\circ}$
e) $\cot\theta = -\sqrt{3}$ $\tan\theta = -\frac{\sqrt{3}}{3}$ $\underline{\theta = 150^\circ \text{ or } 330^\circ}$	f) $\sec\theta = \infty$ $\cos\theta = \frac{1}{\infty}$ $\underline{\theta = 90^\circ \text{ or } 270^\circ}$	g) $\cot\theta = 0$ $\frac{\cos\theta}{\sin\theta} = 0$ $\cos\theta = 0$ $\underline{\theta = 90^\circ \text{ or } 270^\circ}$	h) $\csc\theta = -1$ $\sin\theta = -1$ $\underline{\theta = 270}$

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i) $6\sec\theta = 4\sqrt{3}$ $\cos\theta = \frac{\sqrt{3}}{2}$ $\theta = 30^\circ$ or 330°	j) $3\csc\theta + 2\sqrt{3} = 0$ $\sin\theta = -\frac{\sqrt{3}}{2}$ $\theta = 240^\circ$ or 300°	k) $\tan\theta - \sqrt{3} = 0$ $\tan\theta = \sqrt{3}$ $\theta = 60^\circ$ or 240°	L) $\sqrt{3}\sec\theta + 2 = 0$ $\cos\theta = -\frac{\sqrt{3}}{2}$ $\theta = 150^\circ$ or 210°
m) $2\csc^2\theta - 1 = 3$ $\sin\theta = \pm\frac{\sqrt{2}}{2}$ $\theta = 45^\circ, 135^\circ, 225^\circ, 315^\circ$	n) $\tan^2\theta = 9$ $\tan\theta = \pm 3$ $\theta = 71.565^\circ, 108.434^\circ,$ $251.565^\circ, 288.434^\circ$	o) $\cos^2\theta - \cos\theta - 2 = 0$ $\cos\theta = x$ $(x-2)(x+1) = 0$ $\cos\theta = 2$ $\cos\theta = -1$ X $\theta = 180^\circ$	p) $\frac{-2}{\csc\theta} + \csc\theta = 1$ $(x-2)(x+1) = 0$ $\sin\theta = \frac{1}{2}$ $\sin\theta = -1$ $\theta = 30^\circ, 150^\circ, 270^\circ$

6. Given that $\sin^2\theta + \cos^2\theta = 1$ and $\tan^2\theta = 1.25$, what is the value of $\sec^2\theta$?

$\tan^2\theta = \frac{\sin^2\theta}{\cos^2\theta} = \frac{5}{4}$ $\sec^2\theta = \frac{1}{\cos^2\theta} = \frac{9}{4}$

$\frac{1-\cos^2\theta}{\cos^2\theta} = \frac{5}{4}$

$\cos^2\theta = \frac{4}{9}$

$\frac{9}{4}$

7. If θ is an angle whose measure is not an integer multiple of $90°$, prove that $\cot\theta - \cot 2\theta = \frac{1}{\sin 2\theta}$

$\frac{\cos\theta}{\sin\theta} - \frac{\cos^2\theta - \sin^2\theta}{2\sin\theta\cos\theta} = \frac{1}{2\sin\theta\cos\theta}$

$2\cos^2\theta - (\cos^2\theta - \sin^2\theta) = 1$

$\cos^2\theta + \sin^2\theta = 1$

$1 = 1$ ✓

8. Simplify the following expression: $\frac{\sec A - \cos A}{\tan A}$

$\left(\frac{1}{\cos A} - \cos A\right) \times \frac{\cos A}{\sin A} = \frac{1-\cos^2 A}{\cancel{\cos A}} \times \frac{\cancel{\cos A}}{\sin A} = \frac{\sin^2 A}{\sin A} = \sin A$

a) $\sin A$ b) $\cos A$ c) $\sec A$ d) $\csc A$ e) $\cot A$

9. Simplify the following expression: $\frac{1+\sec A}{\tan A + \sin A}$

$\frac{\cos A + 1}{\cos A} \div \frac{\sin A + \cos A \sin A}{\cos A}$

$= \frac{\cos A + 1}{\sin A + \cos A \sin A} = \frac{\cancel{\cos A + 1}}{\sin A(\cancel{\cos A + 1})} = \frac{1}{\sin A} = \csc A$

a) $\sin A$ b) $\cos A$ c) $\sec A$ d) $\csc A$ e) $\cot A$

10. Simplify the following expression: $\frac{\tan A + \cot A}{\sec A}$

$\cancel{\cos A}\left(\frac{1}{\sin A \cancel{\cos A}}\right) = \csc A$

a) $\sin A$ b) $\cos A$ c) $\sec A$ d) $\csc A$ e) $\cot A$

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11. Simplify the following expression: $\dfrac{1+\sin A}{1+\csc A}$ $\quad 1+\sin A \times \dfrac{\sin A}{\sin A+1} = \sin A$

a) $\sin A$ b) $\cos A$ c) $\sec A$ d) $\csc A$ e) $\cot A$

12. Simplify the following expression: $\dfrac{1+\sec A}{1+\cos A}$ $\quad 1+\dfrac{1}{\cos A} \div (1+\cos A)$

$\dfrac{\cos A+1}{\cos A} \div (1+\cos A) = \dfrac{1}{\cos A} = \sec A$

a) $\sin A$ b) $\cos A$ c) $\sec A$ d) $\csc A$ e) $\cot A$

13. Simplify the following expression: $\dfrac{1+\cot A}{1+\tan A}$ $\quad 1+\dfrac{1}{\tan A} \div (1+\tan A)$

$\dfrac{\tan A+1}{\tan A} \div (\tan A+1) = \dfrac{1}{\tan A} = \cot A$

a) $\sin A$ b) $\cos A$ c) $\sec A$ d) $\csc A$ e) $\cot A$

14. Prove that both sides of the equation are equal: $\dfrac{\sin A+\cos A\cot A}{\cos A\csc A} = \sec A$

$\sin A + \dfrac{\cos^2 A}{\sin A} \div \dfrac{\cos A}{\sin A} = \dfrac{1}{\cos A}$

$\dfrac{1}{\sin A} \times \dfrac{\sin A}{\cos A} = \dfrac{1}{\cos A}$

$\dfrac{1}{\cos A} = \dfrac{1}{\cos A}$ ✓

15. Prove that both sides of the equation are equal: $\dfrac{1-\cos A}{\sin A} = \dfrac{1}{\csc A+\cot A}$

$= 1 \div \left(\dfrac{1}{\sin A} + \dfrac{\cos A}{\sin A}\right)$

$\dfrac{1-\cos A}{\sin A} = \dfrac{\sin A}{\cos A+1}$

$\sin^2 A = 1-\cos A^2$

$\sin^2 A = \sin^2 A$ ✓

16. Challenge: What are all the values of "x" between 0 *and* 2π that satisfy the equation?

$$\left(5+2\sqrt{6}\right)^{\sin x} + \left(5-2\sqrt{6}\right)^{\sin x} = 2\sqrt{3}$$

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Name: Aiden Kim Date: ???

Math 10/11 Enriched: Section 4.8 Proving and Verifying Basic Trigonometric Identities

$\sin(-x) = -\sin x$ $\tan x = \dfrac{\sin x}{\cos x}$ $\csc x = \dfrac{1}{\sin x}$ $\sec x = \dfrac{1}{\cos x}$ $\cot x = \dfrac{1}{\tan x}$

$\cos(-x) = \cos x$ $\sin^2 x + \cos^2 = 1$ $\sin 2x = 2\sin x \cos x$

1. ***Verify*** which of the following are trigonometric identities:

a) $\tan x + \cot x = \sec x \csc x$ $\frac{1}{\sin x \cos x} = \frac{1}{\sin x \cos x}$ ✓ YES	b) $\sec^2 x + \csc^2 x = \sec^2 x \boxed{+} \csc^2 x$ didn't load? ✓ YES
c) $\sec^2 x - \csc^2 x = \dfrac{\sec^2 x}{\csc^2 x}$ $x = 10$ $0.93969 \neq 32.163$ ✗ NO	d) $\sec^2 x + \csc^2 x = (\tan x + \cot x)^2$ $x = 20$ $9.679 = 9.679$ ✓ YES
e) $\cos^2 x = \sin x(\csc x + \sin x)$ $x = 20$ $0.883 \neq 1.117$ ✗ NO	f) $\sin^2 x = \cos x(\sec x - \cos x)$ $x = 20$ $0.117 = 0.117$ ✓ YES
g) $\sin x \tan x + \sec x = \dfrac{\sin^2 x + 1}{\cos x}$ $x = 20$ $1.189 = 1.189$ ✓ YES	h) $\dfrac{\sin x + \tan x}{\cos x + 1} = \tan x$ $x = 20$ $0.364 = 0.364$ ✓ YES

2. Simplify each of the following expressions:

a) $\sin^2 x + \cos^2 x + \cot^2 x$ $= 1 + \dfrac{\cos^2 x}{\sin^2 x}$ $= \dfrac{1}{\sin^2 x}$ $= \csc^2 x$ $\csc^2 x$	b) $\dfrac{\sin 2x}{1 + \cos 2x} = \dfrac{2\sin x \cos x}{1 + \cos^2 x - \sin^2 x} = \dfrac{\cancel{2}\sin x \cancel{\cos x}}{\cancel{2}\cancel{\cos^2 x}}$ $\cos x$ $\tan x$

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c) $\dfrac{\sin 3x}{\sin x} - \dfrac{\cos 3x}{\cos x}$ $= \dfrac{\sin 3x \cos x - \sin x \cos 3x}{\sin x \cos x}$ $= \dfrac{\sin(3x - x)}{\sin x \cos x} = \dfrac{\sin 2x}{\sin x \cos x}$ $= \dfrac{2 \cancel{\sin x \cos x}}{\cancel{\sin x \cos x}} = 2$ $\underline{2}$	d) $\cos(a+b)\cos b + \sin(a+b)\sin b$ $= \cos a \cos^2 b - \sin a \sin b \cos b + \sin a \cos b \sin b + \sin b^2 \cos a$ $= \cos a \cos^2 b + \cos a \sin^2 b$ $= \cos a (\sin^2 b + \cos^2 b)$ $= \cos a$ $\underline{\cos a}$
e) $\sin\left(\frac{\pi}{3} - x\right)\cos\left(\frac{\pi}{3} + x\right) + \cos\left(\frac{\pi}{3} - x\right)\sin\left(\frac{\pi}{3} + x\right)$ $= \sin\left(\frac{\pi}{3} - x + \frac{\pi}{3} + x\right)$ $= \sin \frac{2\pi}{3}$ $= \sin 120^\circ$ $= \frac{\sqrt{3}}{2}$ $\underline{\dfrac{\sqrt{3}}{2}}$	f) $\dfrac{\cos^3 x - \cos x}{\sin^3 x} = \dfrac{\cos x(\cos^2 x - 1)}{\sin^3 x} = \dfrac{\cos x(-\cancel{\sin^2 x})}{\cancel{\sin^2 x}\sin x}$ $= -\dfrac{\cos x}{\sin x} = -\cot x$ $\underline{-\cot x}$

3. Suppose $0 < x < 90°$ and $2\sin^2 x + \cos^2 x = \dfrac{25}{16}$. What is the value of $\sin x$?

$\sin^2 x = \frac{9}{16}$

$\sin x = \frac{3}{4}$

$\underline{\sin x = \frac{3}{4}}$

4. Evaluate the following: $\sin\left(\dfrac{\pi}{6}\right) + \sin^2\left(\dfrac{\pi}{6}\right) + \cos^2\left(\dfrac{\pi}{6}\right)$

$\sin 30^\circ + \sin^2 30^\circ + \cos^2 30^\circ$

$= 1 + \frac{1}{2} = \frac{3}{2}$

$\underline{\frac{3}{2}}$

5. Determine the value of $\sin^2\left(\dfrac{\pi}{8}\right) + \cos^2\left(\dfrac{3\pi}{8}\right) + \sin^2\left(\dfrac{5\pi}{8}\right) + \cos^2\left(\dfrac{7\pi}{8}\right)$

$\sin^2\left(\frac{7\pi}{8}\right) + \sin^2\left(\frac{3\pi}{8}\right) + \cos^2\left(\frac{3\pi}{8}\right) + \cos^2\left(\frac{7\pi}{8}\right)$

$1 + 1 = 2$

$\underline{2}$

6. Suppose that, for some angles "x" and "y" $\sin^2 x + \cos^2 y = \dfrac{3a}{2}$ and $\cos^2 x + \sin^2 y = \dfrac{1}{2}a^2$, determine the possible value(s) of "a".

$\sin^2 x + \cos^2 y + \cos^2 x + \sin^2 y = \frac{a^2 + 3a}{2}$

$2 = \frac{a^2 + 3a}{2}$

$a^2 + 3a - 4 = 0$

$(a+4)(a-1) = 0$

$\underline{a = 1 \text{ or } -4}$

7. What is the sum of all values of all values of "x" between 0 and 2π inclusive that satisfy the equation: $\tan x + 1 = \sec^2 x$?

$\tan x + 1 = \sec^2 x$

$\tan x + 1 = \tan^2 x + 1$

$\tan x = \tan^2 x$

$\tan^2 x - \tan x = 0$

$\tan x(\tan x - 1) = 0$

$\tan x = 0$ or 1

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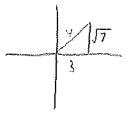
8. If $\cos(x)=\frac{3}{4}$ and "x" is in the first quadrant, what is the value of $\sin(2x)$?



$\sin 2x = 2\sin x \times \frac{3}{4}$

$= 2 \times \frac{\sqrt{7}}{4} \times \frac{3}{4}$

$= \frac{3\sqrt{7}}{8}$

$\frac{3\sqrt{7}}{8}$

9. Suppose that $\sin a+\sin b=\sqrt{\frac{5}{3}}$ and $\cos a+\cos b=1$. What is the value of $\cos(a-b)$?

$\sin^2 a + 2\sin a \sin b + \sin^2 b = \frac{5}{3}$

$\cos^2 a + 2\cos a \cos b + \cos^2 b = 1$

$1 + 1 + 2\sin a \sin b + 2\cos a \cos b = \frac{5}{3}$

$2(\sin a \sin b + \cos a \cos b) = \frac{2}{3}$

$\sin a \sin b + \cos a \cos b = \frac{1}{3}$

$\frac{1}{3}$

10. In degrees, what are all ordered pairs of angles (x,y) for which both angles are between 0 and $90°$ and satisfy the equation $\sin^2 x+\sin^2 y=\sin x+\sin y$?

$\sin x(\sin x - 1) = \sin y(1 - \sin y) \rightarrow$ Both $= 0$

(0,0) (90,90) (0,90) (90,0)

11. In degrees, what are all values of 'x" between 0 *and* $360°$ for which $\sin x > \sqrt{1-\sin^2 x}$?

$\sin x > \sqrt{1-\sin^2 x}$

$\sin^2 x > 1 - \sin^2 x$

$\sin^2 x > \cos^2 x$

$\sin x > \cos x$

$45° < x < 135°$

12. What are the degree measures of all positive angles between 0 and $90°$ which satisfy the equation:

$\underbrace{\sin^2 x+\cos^2 x}_{1}+\tan^2 x+\cot^2 x+\sec^2 x+\csc^2 x=31$

$1 + \sec^2 x - 1 + \csc^2 x - 1 + \sec^2 x + \csc^2 x = 31$

$2\sec^2 x + 2\csc^2 x = 32$

$\sec^2 x + \csc^2 x = 16$

$\frac{1}{\cos^2 x} + \frac{1}{\sin^2 x} = 16$

$\frac{1}{\sin^2 x \cos^2 x} = 16$

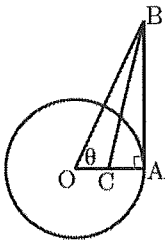
$\sin x \cos x = \pm \frac{1}{4}$

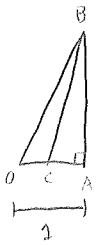
$\sin 2x = \pm \frac{1}{2}$

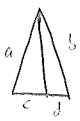
$x = 15°, 75°$

13. A circle centered at "O" has radius 1 and contains the point A. Segment AB is tangent to the circle at "A" and $\angle AOB=\theta$. If point "C" lies on $\overline{OA}$ and $\overline{BC}$ bisects $\angle ABO$, then what is the length of OC?

a) $\sec^2\theta-\tan\theta$ b) $\frac{1}{2}$ c) $\frac{\cos^2\theta}{1+\sin\theta}$ d) $\frac{1}{1+\sin\theta}$ e) $\frac{\sin\theta}{\cos^2\theta}$







$c = \frac{a}{a+b}$

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14. If $\cos\theta = 2\tan\theta$, solve for the numerical value of $\cos^2\theta$.

$\cos^2\theta = \frac{4\sin^2\theta}{\cos^2\theta}$

$= \frac{4(1-\cos^2\theta)}{\cos^2\theta}$

$\cos^4\theta = 4 - 4\cos^2\theta$

$\cos^4\theta + 4\cos^2\theta - 4 = 0$

$\frac{-4 \pm \sqrt{32}}{2} = -2 \pm 2\sqrt{2}$

$\underline{-2 \pm 2\sqrt{2}}$

15. Simplify: $\cos\left(\frac{\pi}{6}+x\right)\cos\left(\frac{\pi}{6}-x\right) - \sin\left(\frac{\pi}{6}+x\right)\sin\left(\frac{\pi}{6}-x\right)$

$= \cos\left(\frac{\pi}{6} + x + \frac{\pi}{6} - x\right)$

$= \cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$

$\underline{\frac{1}{2}}$

16. If $\sin x = \frac{-1}{3}$ and "x" is in quadrant 3, then what is the value of $\sin 2x$?

$2\sin x \cos x$

$= 2 \times -\frac{1}{3} \times -\frac{2\sqrt{2}}{3}$

$= \frac{4\sqrt{2}}{9}$

$\underline{\frac{4\sqrt{2}}{9}}$

17. What is the value of $\sin(a+b)$ if $\sin a = \frac{-3}{5}$ and $\cos b = \frac{3}{5}$, with both "a" and "b" in the fourth quadrant.

$\sin a \cos b + \sin b \cos a$

$= -\frac{3}{5} \times \frac{3}{5} + \left(-\frac{4}{5} \times \frac{4}{5}\right)$

$= -\frac{9}{25} - \frac{16}{25} = -1$

$\underline{-1}$

18. Simplify the expression: $(\sin x - \cos x)^2 - (\sin x + \cos x)^2$

a) 0 b) $-\sin 2x$ c) $\sin 2x$ d) $-2\sin 2x$

$(\sin x - \cos x + \sin x + \cos x)(\sin x - \cos x - \sin x - \cos x)$

$= (2\sin x)(-2\cos x)$

$= -4\sin x \cos x = -2\sin 2x$

19. Challenge: Evaluate and simplify the following without a calculator: $(\cos 36°)(\cos 108°)$

Did extensively in class, please give me effort points pretty please

(a) Suppose that, for some angles x and y,

$$\sin^2 x + \cos^2 y = \tfrac{3}{2}a$$
$$\cos^2 x + \sin^2 y = \tfrac{1}{2}a^2$$

Determine the possible value(s) of a.

$\sin^2 x + \cos^2 x + \sin^2 y + \cos^2 y = \frac{1}{2}a^2 + \frac{3}{2}a$

$2 = \frac{1}{2}a^2 + \frac{3}{2}a$

$4 = a^2 + 3a$

$a^2 + 3a - 4 = 0$

$(a-1)(a+4) = 0$

$\underline{a = 1 \text{ or } -4}$

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Name: Aiden Kim Date:_____

M10/11H HW Section 4.9 P1 Sum and Difference Identities

$\sin(a-b)=\sin a\cos b-\sin b\cos a$ $\cos(a+b)=\cos a\cos b-\sin b\sin a$ $\sin(a+b)=\sin a\cos b+\sin b\cos a$

$\cos(a-b)=\cos a\cos b+\sin b\sin a$ $\tan(a+b)=\dfrac{\tan a+\tan b}{1-\tan a\tan b}$ $\tan(a-b)=\dfrac{\tan a-\tan b}{1+\tan a\tan b}$

1. Using two of any of these angles: $30°,\ 45°,\ 60°,\ 90°,\ 180°,\ 270°,$ and $360°$, add or subtract them to see how many angles that you can create: ie: $75°=30°+45°$

Many angles...

Like a lot

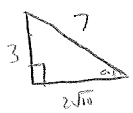
2. Find the exact ratio of sine and cosine of the following angles:
$30°,\ 45°,\ 60°,\ 90°,\ 135°,\ 150°,\ 210°,\ 225°,\ 240°,\ 300°, 315°,$ and $330°$

tan 30° tan 90° tan 210° tan 300°

tan 45° tan 135° tan 225° tan 315°

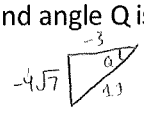
tan 60° tan 150° tan 240° tan 330°

3. If we are given the ratio $\sin a=\dfrac{3}{7}$, what is the value of $\cos a=??$



$\pm\dfrac{2\sqrt{10}}{7}$

4. If $\cos Q=\dfrac{-3}{11}$ and angle Q is in quadrant 3, then what is the value of $\sin Q$??



$\dfrac{-4\sqrt{7}}{11}$

5. IF $\sin\theta=\dfrac{-\sqrt{5}}{7}$, then what is the value of $\sin(-\theta)$ equal to? Explain

$\sin(-\theta) = -\sin\theta$

$\dfrac{\sqrt{5}}{7}$

6. IF $\cos\theta=\dfrac{-9}{\sqrt{101}}$, then what is the value of $\cos(-\theta)$ equal to? Explain

$\cos(-\theta) = \cos\theta$

$-\dfrac{9}{\sqrt{101}}$

7. How can we use the sum and difference identities to find the exact value of $\sin 75°$? Explain:

$\sin(30°+45°) = \sin 30°\cos 45° + \sin 45°\cos 30°$

And since sin 30° and 45° and cos 30° and 45° are exact numbers we know, we can get the exact value of sin 75°.

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8. Is the following an identity? $\cos(a-b)=\cos a-\cos b$? Explain:

No, $\cos(a-b)=\cos a\cos b-\sin a\sin b$

9. Given that $\tan\theta=\dfrac{\sin\theta}{\cos\theta}$, what is $\tan(a+b)=??$ What is $\tan(a-b)=??$

$\tan(a+b)=\dfrac{\tan a+\tan b}{1-\tan a\tan b}$ $\tan(a-b)=\dfrac{\tan a-\tan b}{1+\tan a\tan b}$

10. Find the exact value of each trigonometric expression:

a) $\sin(45°+30°)=\frac{\sqrt{6}+\sqrt{2}}{4}$ $\frac{\sqrt{6}+\sqrt{2}}{4}$	b) $\cos\left(\frac{3\pi}{4}+\frac{2\pi}{3}\right)$ $\cos\left(\frac{17}{12}\pi\right)=\cos 255°$ $\frac{-\sqrt{6}+\sqrt{2}}{4}$
c) $\cos(120°+45°)=\cos(165°)$ $-\left(\frac{\sqrt{6}+\sqrt{2}}{4}\right)$	d) $\sin(-15°)$ $\frac{-\sqrt{6}+\sqrt{2}}{4}$
e) $\cos\left(\frac{5\pi}{12}\right)=\cos 75°$ $\frac{\sqrt{6}-\sqrt{2}}{4}$	f) $\cos(255°)$ $\frac{-\sqrt{6}+\sqrt{2}}{4}$
g) $\tan(300°-45°)$ $2+\sqrt{3}$	h) $\tan(300°+45°)$ $-2+\sqrt{3}$
i) $\cos 195°$ $-\left(\frac{\sqrt{6}+\sqrt{2}}{4}\right)$	j) $\tan\left(\frac{\pi}{12}\right)$ $2-\sqrt{3}$
k) $\sin\left(\frac{5\pi}{12}\right)=\sin 75°$ $\frac{\sqrt{6}+\sqrt{2}}{4}$	L) $\sin 375°$ $\frac{\sqrt{6}-\sqrt{2}}{4}$

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11. Simplify each expression to an exact form:

a) $\cos(\theta+2\pi)$ $= \sin\theta$ $\sin\theta$	b) $\sin\left(\theta-\frac{3\pi}{2}\right)$ $= \sin\theta \times 0 - \cos\theta \times -1$ $= \cos\theta$ $\cos\theta$
c) $\tan\left(\theta+\frac{\pi}{2}\right)$ $\tan(\theta+90^\circ)$	d) $\cos(\theta-2\pi)$ $= \cos\theta + 0$ $\cos\theta$
a) $\cos 70^\circ\cos 20^\circ+\sin 70^\circ\sin 20^\circ$ $= \cos(70^\circ-20^\circ)$ $\cos 50^\circ$	b) $\sin 20^\circ\cos 10^\circ+\cos 20^\circ\sin 10^\circ$ $= \sin 30^\circ = \frac{1}{2}$ $\frac{1}{2}$
c) $\cos 110^\circ\cos 10^\circ-\sin 110^\circ\sin 10^\circ$ $= \cos 120^\circ = -\frac{1}{2}$ $-\frac{1}{2}$	d) $\cos\frac{\pi}{3}\cos\frac{\pi}{4}+\sin\frac{\pi}{3}\sin\frac{\pi}{4}$ $= \cos 15^\circ$ $\frac{\sqrt{6}+\sqrt{2}}{4}$
e) $\sin 42^\circ\cos 17^\circ-\cos 42^\circ\sin 17^\circ$ $= \sin 25^\circ$ $\sin 25^\circ$	f) $\dfrac{\tan\left(\frac{\pi}{9}\right)+\tan\left(\frac{5\pi}{36}\right)}{1-\tan\left(\frac{\pi}{9}\right)\tan\left(\frac{5\pi}{36}\right)}$ $= \tan(45)^\circ$ 1
g) $\sin\left(\frac{\pi}{3}-x\right)\cos\left(\frac{\pi}{3}+x\right)+\cos\left(\frac{\pi}{3}-x\right)\sin\left(\frac{\pi}{3}+x\right)$ $= \sin 120^\circ$ $\frac{\sqrt{3}}{2}$	H) $\sin a\cos 2a+\cos a\sin 2a$ $= \sin 3a$ $\sin 3a$

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12. If $\sin a = \frac{4}{9}$, $90° < a \le 180°$, then what is the exact value of $\sin(a+180°)$ equal to?

$\sin a = \frac{4}{9}$

$\sin(a+180°) = -\frac{4}{9}$

$-\frac{4}{9}$

13. Given that $\sin 30° = \frac{1}{2}$, $\cos 30° = \frac{\sqrt{3}}{2}$, and $\cos 45° = \sin 45° = \frac{1}{\sqrt{2}}$ find the exact value of $\cos 75°$, $\sin 75°$ $\sin 15°$, and $\cos 15°$.

$\cos 75° = \cos 30° \cos 45° - \sin 30° \sin 45°$

$= \frac{\sqrt{6}-\sqrt{2}}{4} = \sin 15°$

$\cos 15° = \cos 45° \cos 30° + \sin 45° \sin 30°$

$= \frac{\sqrt{6}+\sqrt{2}}{4} = \sin 75°$

$\cos 75° = \sin 15° = \frac{\sqrt{6}-\sqrt{2}}{4}$

$\cos 15° = \sin 75° = \frac{\sqrt{6}+\sqrt{2}}{4}$

$\sqrt{33}$ 7 4

$\sin b = \frac{\sqrt{33}}{7}$

3 5 4

14. Given that $\sin a = \frac{3}{5}$ and $\cos b = \frac{4}{7}$, where both angles "a" and "b" are in quadrant 1, then find the following:

$\sin(a+b)$, $\sin(a-b)$, $\cos(a+b)$, and $\cos(a-b)$

$= \sin a \cos b + \sin b \cos a$

$= \frac{3}{5} \times \frac{4}{7} + \frac{\sqrt{33}}{7} \times \frac{4}{5}$

$= \frac{12+4\sqrt{33}}{35}$

$= \frac{12-4\sqrt{33}}{35}$

$= \frac{4}{5} \times \frac{4}{7} - \frac{3}{5} \times \frac{\sqrt{33}}{7}$

$= \frac{16-3\sqrt{33}}{35}$

$= \frac{16+3\sqrt{33}}{35}$

15. Simplify the following: $\cos\left(x+\frac{\pi}{2}\right) - \cos\left(x-\frac{\pi}{2}\right)$

$-\sin x + \sin x$

a) 0 b) $-2\sin x$ c) $2\sin x$ d) $2\cos x$ e) $-2\cos x$

16. Suppose $\cos x = 0$ and $\cos(x+z) = 0.5$. What is the smallest possible positive value of "z"?

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{\pi}{2}$ (D) $\frac{5\pi}{6}$ (E) $\frac{7\pi}{6}$

$\cos -90° = 0$

$\cos 60° = 0.5$

$150° = \frac{5\pi}{6}$

17. Suppose that $\sin a + \sin b = \sqrt{5/3}$ and $\cos a + \cos b = 1$. What is $\cos(a-b)$

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Name: Aiden Kim Date:_____

M10/11H HW Section 4.9 Part 2 Double Angle Identities

$\sin(a-b)=\sin a\cos b-\sin b\cos a$ $\cos(a+b)=\cos a\cos b-\sin b\sin a$ $\sin(a+b)=\sin a\cos b+\sin b\cos a$

$\cos(a-b)=\cos a\cos b+\sin b\sin a$ $\tan(a+b)=\dfrac{\tan a+\tan b}{1-\tan a\tan b}$ $\tan(a-b)=\dfrac{\tan a-\tan b}{1+\tan a\tan b}$

$\sin 2a=2\sin a\cos a$ $\cos 2a=\cos^2 a-\sin^2 a$ $\cos 2a=1-2\sin^2 a$ $\cos 2a=2\cos^2 a-1$

1. How do we derive the equation $\cos 2\theta=\cos^2\theta-\sin^2\theta$ from $\cos(a+b)=\cos a\cos b-\sin a\sin b$?

$a=b=\theta$

$\sin 2\theta=\sin\theta\cos\theta+\sin\theta\cos\theta$

$=2\sin\theta\cos\theta$

2. How do we derive the equation $\sin 2\theta=2\sin\theta\cos\theta$ from the identity $\sin(a+b)=\sin a\cos b+\sin b\cos a$?

$a=b=\theta$

$\sin 2\theta=\sin\theta\cos\theta+\sin\theta\cos\theta$

$=2\sin\theta\cos\theta$

3. When proving an identity that involves $\cos 2\theta$, how do we tell which of the three equations to use? Should we convert it to $\cos^2\theta-\sin^2\theta$, $1-2\sin^2\theta$, OR $2\cos^2\theta-1$? Are they the same?

They are the same, so it doesn't matter

4. Prove that $\cos 2\theta=1-2\sin^2\theta$ and $\cos 2\theta=2\cos^2\theta-1$

$\cos^2\theta-\sin^2\theta=1-2\sin^2\theta$

$\cos^2\theta+\sin^2\theta-\sin^2\theta+\sin^2\theta=1-2\sin^2\theta$

$1-2\sin^2\theta=1-2\sin^2\theta$

$\cos^2\theta-\sin^2\theta=2\cos^2\theta-1$

$\cos^2\theta+\cos^2\theta-\cos^2\theta-\sin^2\theta=2\cos^2\theta-1$

$2\cos^2\theta-1=2\cos^2\theta$

5. Can we simplify the equation like this? Explain why or why not:

$$\frac{\sin 2\theta}{2}=\frac{\sin \cancel{2}\theta}{\cancel{2}}=\sin\theta$$

No. $\dfrac{\sin 2\theta}{2}=\dfrac{2\sin\theta\cos\theta}{2}=\sin\theta\cos\theta$

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6. Use the double angle identities to simplify each of the following to a single trigonometric function. Show all your work and steps:

a) $2\sin 0.4\cos 0.4$ $\sin 0.8$	b) $2\sin 5\cos 5$ $\sin 5$
c) $\cos^2 0.7 - \sin^2 0.7$ $\cos 1.4$	d) $2\sin\frac{\pi}{7}\cos\frac{\pi}{7}$ $\sin\frac{\pi}{7}$
e) $\cos^2\frac{\pi}{9} - \sin^2\frac{\pi}{9}$ $\cos\frac{2\pi}{9}$	f) $2\cos^2 75° - 1$ $\cos 150° = -\frac{\sqrt{3}}{2}$

7. Given that $\sin\theta = \frac{2}{3}$, where θ is in Q1, find the exact value of the following: $\sin 2\theta$, $\cos 2\theta$, and $\tan 2\theta$

$\cos\theta = \frac{\sqrt{5}}{3}$

$\sin 2\theta = 2\left(\frac{2\sqrt{5}}{9}\right) = \frac{4\sqrt{5}}{9}$

$\cos 2\theta = \frac{4}{9} - \frac{5}{9} = -\frac{1}{9}$

$\tan 2\theta = \frac{\frac{4\sqrt{5}}{9}}{-\frac{1}{9}} = -4\sqrt{5}$

8. Given that $\tan\theta = -\frac{5}{6}$, where θ is in Q2, find the exact value of the following: $\sin 2\theta$, $\cos 2\theta$, and $\tan 2\theta$

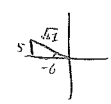
$\sin\theta = \frac{5}{\sqrt{61}}$ $\cos\theta = -\frac{6}{\sqrt{61}}$

$\sin 2\theta = 2 \times \frac{5}{\sqrt{61}} \times -\frac{6}{\sqrt{61}}$

$= -\frac{60}{61}$

$\cos 2\theta = \frac{11}{61}$

$\tan 2\theta = \frac{60}{11}$



9. Solve the following equation for $0 \le \theta \le 2\pi$ using sum and difference identities:

a) $\sin\left(\theta + \frac{\pi}{2}\right) = \frac{1}{2}$ $\cos\theta = \frac{1}{2}$ $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$	b) $\cos\left(\frac{3\pi}{2} + \theta\right) + \sin\left(\frac{3\pi}{2} - \theta\right) = 0$ $\sin\theta - \cos\theta = 0$ $\sin\theta = \cos\theta$ $\theta = \frac{\pi}{4}, \frac{5\pi}{4}$
c) $\sin\left(\theta + \frac{\pi}{3}\right) + \sin\left(\theta - \frac{\pi}{3}\right) = 1$ $\sin\theta = 1$ $\theta = \frac{\pi}{2}$	d) $\cos\left(\theta - \frac{\pi}{6}\right) + \sin\left(\theta - \frac{\pi}{3}\right) = \sin\theta$ $\sin\theta = \sin\theta$ All real values θ

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10. Prove the following identities:

a) $\sin(270° + \theta) = -\cos\theta$ $\sin 270° \cos\theta + \sin\theta \cos 270° = -\cos\theta$ $= \cos\theta \cancel{=} -\cos\theta$	b) $\sin(2\pi + \theta) = \sin\theta$ $\sin 360° \cos\theta + \cos 360° \sin\theta = \sin\theta$ $\sin\theta = \sin\theta$
c) $\cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta$ $\cos 90° \cos\theta + \sin 90° \sin\theta = \sin\theta$ $\sin\theta = \sin\theta$	d) $\cos(a + m) - \cos(a - m) = -2\sin a \sin b$ $\cos a \cos b - \sin a \sin b - \cos a \cos b - \sin a \sin b = -2\sin a \sin b$ $-2\sin a \sin b = -2\sin a \sin b$
e) $\cos(A + B) \cos B + \sin(A + B) \sin B = \cos A$ $\cos a$	$\sin(x + y) + \sin(x - y) = 2\sin x \cos y$ $\sin x \cos y + \sin y \cos x + \sin x \cos y - \sin y \cos x = 2\sin x \cos y$ $2\sin x \cos y = 2\sin x \cos y$

11. Prove the following identities:

a) $\sin(3\pi - \theta) = \sin\theta$ $\sin 3\pi \cos\theta - \sin\theta \cos 3\theta = \sin\theta$ $0 \cos\theta - (-1)\sin\theta = \sin\theta$ $\sin\theta = \sin\theta$	b) $\cos(a + b) + \cos(a - b) = 2\cos a \cos b$ $\cos a \cos b - \cancel{\sin a \sin b} + \cos a \cos b + \cancel{\sin a \sin b} = 2\cos a \cos b$ $2\cos a \cos b = 2\cos a \cos b$

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c) $\dfrac{\sin^2\theta+\cos^2\theta}{\sin^2\theta-\cos^2\theta}=-\sec 2\theta$

$\dfrac{1}{\sin^2\theta-\cos^2\theta}=-\dfrac{1}{\cos 2\theta}$

$\cos 2\theta=\cos^2\theta-\sin^2\theta$

$\cos 2\theta=\cos 2\theta$

d) $\tan a-\tan b=\dfrac{\sin(a-b)}{(\cos a)(\cos b)}$

$\dfrac{\sin a}{\cos a}-\dfrac{\sin b}{\cos b}=\dfrac{\sin a\cos b-\sin b\cos a}{\cos a\cos b}$

$\dfrac{\sin a\cos b-\sin b\cos a}{\cos a\cos b}=\dfrac{\sin a\cos b-\sin b\cos a}{\cos a\cos b}$

e) $1+\sin 2\theta=(\sin\theta+\cos\theta)^2$

$1+2\sin a\cos a=\sin^2\theta+2\sin\theta\cos\theta+\cos^2\theta$

$1+2\sin\theta\cos\theta=1+2\sin\theta\cos\theta$

f) $\sin 2\theta=2\cot\theta\sin^2\theta$

$2\sin\theta\cos\theta=2\times\dfrac{\cos\theta}{\cancel{\sin\theta}}\times\sin^{\cancel{2}}\theta$ ($\sin\theta$)

$2\sin\theta\cos\theta=2\sin\theta\cos\theta$

g) $\cos 2\theta=\dfrac{1-\tan^2\theta}{1+\tan^2\theta}$

$\cos 2\theta=\dfrac{1-\dfrac{\sin^2\theta}{\cos^2\theta}\rightarrow\dfrac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}}{1+\dfrac{\sin^2\theta}{\cos^2\theta}\rightarrow\dfrac{\cos^2\theta+\sin^2\theta}{\cos^2\theta}}$

$=\dfrac{\cos^2\theta-\sin^2\theta}{\cos^2\theta}\times\dfrac{\cancel{\cos^2\theta}}{\cos^2\theta+\sin^2\theta\rightarrow 1}$

$=\cos^2\theta-\sin^2\theta$

$\cos 2\theta=\cos 2\theta$

h) $\sec^2\theta=\dfrac{2}{1+\cos 2\theta}$

$\dfrac{1}{\cos^2\theta}=\dfrac{2}{1+\cos 2\theta}$

$2\cos^2\theta=1+\cos 2\theta$

$2\cos^2\theta=1+\cos^2\theta-\sin^2\theta$

$\cos^2\theta+\sin^2\theta=1$

$1=1$

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i) $\dfrac{1-\cos 2\theta}{2} = \sin^2\theta$

$1 - \cos^2\theta + \sin^2\theta = 2\sin^2\theta$

$1 = \sin^2\theta + \cos^2\theta$

$1 = 1$

J) $\dfrac{(\sin\theta + \cos\theta)^2}{\sin 2\theta} = \csc 2\theta + 1$

$\dfrac{1 + 2\sin\theta\cos\theta}{2\sin\theta\cos\theta} = \dfrac{1}{\sin 2\theta} + 1$

$\dfrac{1 + 2\sin\theta\cos\theta}{2\sin\theta\cos\theta} = \dfrac{1}{2\sin\theta\cos\theta} + 1$

$\dfrac{1 + 2\sin\theta\cos\theta}{2\sin\theta\cos\theta} = \dfrac{1 + 2\sin\theta\cos\theta}{2\sin\theta\cos\theta}$

K) $\dfrac{\sin 3x}{\sin x} - \dfrac{\cos 3x}{\cos x} = 2$

$\dfrac{\sin 3x\cos x - \sin x\cos 3x}{\sin x\cos x} = 2$

$\sin(3x - x) = 2\sin x\cos x$

$\sin 2x = 2\sin x\cos x$

$2\sin x\cos x = 2\sin x\cos x$

L) $4\cos^2\theta + \cos(2\theta) = 5 - 6\sin^2\theta$

$4\cos^2\theta + 6\sin^2\theta + \cos 2\theta - 5 = 0$

$4 + 2\sin^2\theta + \cos^2\theta - \sin^2\theta = 5$

$4 + 1 = 5$

$5 = 5$

m) $\cos^4 x - \sin^4 x = \cos(2x)$

$(\cos^2 x + \sin^2 x)(\cos^2 x - \sin^2 x) = \cos 2x$

$\cos^2 x - \sin^2 x = \cos 2x$

$\cos 2x = \cos 2x$

n) $\cot(2\theta) = \dfrac{1}{2}(\cot\theta - \tan\theta)$

$\dfrac{\cos 2\theta}{\sin 2\theta} = \dfrac{1}{2}\left(\dfrac{\cos\theta}{\sin\theta} - \dfrac{\sin\theta}{\cos\theta}\right)$

$\dfrac{\cos^2\theta - \sin^2\theta}{2\sin\theta\cos\theta} = \dfrac{1}{2}\left(\dfrac{\cos^2\theta - \sin^2\theta}{\sin\theta\cos\theta}\right)$

$\dfrac{\cos^2\theta - \sin^2\theta}{\sin\theta\cos\theta} = \dfrac{\cos^2\theta - \sin^2\theta}{\sin\theta\cos\theta}$

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Typo???

O) $\dfrac{\cot\theta - \tan\theta}{\cot\theta + \tan\theta} = \cos(2\theta)$

$\left(\dfrac{\cos\theta}{\sin\theta} - \dfrac{\sin\theta}{\cos\theta}\right) \div \left(\dfrac{\cos\theta}{\sin\theta} + \dfrac{\sin\theta}{\cos\theta}\right) = \cos 2\theta$

$\dfrac{\cos^2\theta - \sin^2\theta}{\cancel{\sin\theta\cos\theta}} \div \dfrac{1}{\cancel{\sin\theta\cos\theta}} = \cos 2\theta$

$\cos^2\theta - \sin^2\theta = \cos 2\theta$

$\cos 2\theta = \cos 2\theta$

P) $\cot^2(2\theta) = \dfrac{\cot^2\theta - 1}{2\cot\theta}$

$\dfrac{\cos^2(2\theta)}{\sin^2(2\theta)} = \left(\dfrac{\cos^2\theta}{\sin^2\theta} - 1\right) \div 2\left(\dfrac{\cos\theta}{\sin\theta}\right)$

$= \dfrac{\cos^2\theta - \sin^2\theta}{\sin^2\theta} \times \dfrac{\cancel{\sin\theta}}{2\cos\theta}$

$\sin\theta$

$= \dfrac{\cos^2\theta - \sin^2\theta}{2\sin\theta\cos\theta}$

$\dfrac{\cos^2 2\theta}{\sin^2 2\theta} = \dfrac{\cos 2\theta}{\sin 2\theta}$

$\sin^2\theta + \cos^2\theta = 1$ $\quad$ $\cos^2\theta - \sin^2\theta = 1 - 2$

Q) $\cos^2(2\theta) - \sin^2(2\theta) = \cos(4\theta)$

$\cos^2(2\theta) - \sin^2(2\theta) = \cos^2(2\theta) - \sin^2(2\theta)$

Lol very short

R) $(4\sin\theta\cos\theta)(1 - 2\sin^2\theta) = \sin(4\theta)$

$(2\sin 2\theta)(\cos^2\theta - \sin^2\theta) = \sin(4\theta)$

$(2\sin 2\theta)(\cos 2\theta) = \sin(4\theta)$

$\sin 4\theta = \sin 4\theta$

S) $3\sin^2\theta\cos^2\theta = \dfrac{3}{8}(1 - \cos(4\theta))$

$3\sin^2\theta\cos^2\theta = \dfrac{3}{8}(1 - \cos^2(2\theta) + \sin^2(2\theta))$

$24\sin^2\theta\cos^2\theta = 3 - 3\cos^2(2\theta) + 3\sin^2(2\theta)$

$2\sin^2(2\theta) = 1 - \cos^2(2\theta) + \sin^2(2\theta)$

$2\sin^2(2\theta) = \sin^2(2\theta) + \sin^2(2\theta)$

$2\sin^2(2\theta) = 2\sin^2(2\theta)$

T) $\sin 2\theta = 2\tan\theta - 2\tan\theta\sin^2\theta$

$2\sin\theta\cos\theta = 2\left(\dfrac{\sin\theta}{\cos\theta}\right) - 2\left(\dfrac{\sin\theta}{\cos\theta}\right)\sin^2\theta$

$\sin\theta\cos\theta = \dfrac{\sin\theta - \sin^3\theta}{\cos\theta}$

$\cos\theta = \dfrac{1 - \sin^2\theta}{\cos\theta}$

$\cos\theta = \dfrac{\cos^2\theta}{\cos\theta}$

$\cos\theta = \cos\theta$

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