Am I Ready for UT Precalculus (Math 107 or 115)?

The intent of these exercises is to help you decide whether you are ready for a university transferable precalculus course (Math 107 or Math 115) or whether you should first upgrade your math skills by refreshing with Math 137 Algebra & Triangle Trigonometry.

All the questions in the following exercises have full solutions. If you find yourself frequently turning to the solutions to help you answer the questions, this is a sign that your background is deficient on this topic. It is important that you be honest with yourself; that is, are you just a bit rusty and the material will come back to you or do you need a comprehensive review. It is unrealistic to think that you can relearn algebra and trigonometry at the same time as you are learning the more advanced concepts and methods in a UT precalculus course.

- If you struggle with most of the problems or do not remember a large proportion of this material, then likely you are not ready for Math 107 or 115 and will want to register in Math137.
- If you can work through many of the questions but it takes a while and you struggle with some of them, then likely you are ready for Math107. This is the easier of the two precalculus courses and is designed to prepare you for Math108 (Applied Calculus).
- If you can do most of the questions, find some of them easy and struggle with just a few, then you are ready for Math115. This is the more challenging precalculus course that will prepare you for Math100.

If you are feeling uncertain as to how to proceed, then please talk with a math instructor or the Chair of the Mathematics Department math@camosun.bc.ca for help choosing the right course and strategy for you.

Section A Operations with Real Numbers

A.1 Evaluating Numerical Expressions

Evaluate each of the following numerical expressions without using a calculator:

1. $\dfrac{9-3(5-8)}{|6-11|}$

2. $-\{2-[4-(3-5)]-(5-2)\}$

3. $-2^4+(-2)^3-2^{-2}$

4. $\dfrac{1}{3^{-1}-4^{-1}}$

A.2 Evaluating Algebraic Expressions

Evaluate the following algebraic expressions for the given values of the variables without using a calculator:

1. a^4-2bc if $a=-2,\ b=3,\ c=-4$

2. $9xy^2-3xy^{-2}$ if $x=\dfrac{1}{2},\ y=-\dfrac{1}{3}$

3. $\dfrac{a^{-1}+b^{-1}}{a^{-1}-b^{-2}}$ if $a=-2, b=3$

Section B Simplifying Algebraic Expressions

B.1 Integer Exponents

Simplify each of the following and write the answers using only positive exponents.

1. $\left(-3x^5y^{-2}z^0\right)\left(8x^3y\right)$

2. $\left(\dfrac{a^2b^{-3}c}{2a^{-1}b^{-2}c^3}\right)^{-4}$

3. $\dfrac{\left(-\frac{2}{5}ay^{-1}\right)^{-3}}{-4a^5y^{-3}}$

B.2 Rational Exponents

Simplify each of the following exponential expressions. Assume that all variables represent positive real numbers. Write your answers using (a) positive exponents and (b) radical notation.

1. $\dfrac{x^{1/3}x^{-5/3}}{x^{-2/3}}$

2. $\left(x^{1/3}y^{3/2}\right)\left(x^{-1/2}y^{1/4}\right)^2$

3. $\left(\dfrac{2y^{-3/4}}{x^{1/4}y^{-5/4}}\right)^{-2}$

Section C Radicals

C.1 Simplifying Radical Expressions

Simplify each of the following radical expressions. Assume that all variables represent positive real numbers.

1. $\sqrt[3]{24}$
2. $\sqrt{125x^5}$
3. $-\sqrt{75x^3y^7}$
4. $\sqrt{18}-\sqrt{50}-3\sqrt{12}-2\sqrt{75}$
5. $\left(2+3\sqrt{5}\right)\left(3-7\sqrt{10}\right)$
6. $-3\sqrt{48x^3}+7x\sqrt{75x}$

C.2 Rationalizing Denominators

Simplify each of the following radical expressions by rationalizing the denominator.

1. $\dfrac{2}{\sqrt{12}}$
2. $\dfrac{2}{5-\sqrt{3}}$
3. $\dfrac{\sqrt{5}-\sqrt{7}}{2\sqrt{5}+\sqrt{7}}$

Section D Polynomial and Rational Expressions

D.1 Expanding and Simplifying Polynomial Expressions

Simplify:

1. $3\left[3-2(x-2)-2(3-4x)\right]$
2. $-4(2x-3)^2-(5x-1)(2x+3)$
3. $(3x-4)\left(7x^2+5x-1\right)$
4. $\left(2x^2y^3-3z^2\right)\left(2x^2y^3+3z^2\right)$

D.2 Factoring Polynomial Expressions

Factor completely:

1. $100x^2-81$
2. $x^2-7x+12$
3. $6x^2+26x-20$
4. $x^2y^2+ab-ay^2-bx^2$
5. $(x+3)(x-1)^2+(x+5)(x-1)^3$

D.3 Simplifying Rational Algebraic Expressions

Simplify:

1. $\dfrac{2x^2-8}{x^2-4x+4}$
2. $\dfrac{x^2-5x-6}{x^2-6x}\cdot\dfrac{6x}{12x+12}$
3. $\dfrac{4}{x+2}+\dfrac{2}{2-x}+\dfrac{1}{x^2-4}$
4. $\dfrac{2}{x^2-3x+2}+\dfrac{6}{x^2-1}$

D.4 Polynomial Division

Divide:

1. $\dfrac{21x^3 - 35x^2 + 14x - 7}{7x}$

2. $(3x^3 - 5x^2 + 10x - 3) \div (3x + 1)$ (Long division)

Section E Solving Equations and Inequalities

E.1 Linear Equations

Solve:

1. $\dfrac{5}{2}x - 7 = 18$

2. $\dfrac{7}{5}(x-1) - \dfrac{3}{2}(x-2) = 1$

Rearrange the equations for the indicated variable:

3. $6w - 5d + 7h = 80$ for w

4. $a = \dfrac{3}{b}(b - y)$ for b

E.2 Quadratic Equations

Solve:

1. $2x^2 = 14x$

2. $3x^2 = 5x - 1$

3. $3x^2 - 4x - 1 = 0$, by completing the square.

E.3 Linear Inequalities

Solve the following inequalities and express your answer in interval notation:

1. $8 - 3x \le 2$

2. $-\dfrac{1}{2} \le \dfrac{3-2x}{2} < \dfrac{5}{4}$

E.4 Rational Equations

Solve:

1. $\dfrac{8}{y} - \dfrac{1}{3} = \dfrac{5}{y}$

2. $\dfrac{x}{x-2} + \dfrac{1}{x-4} = \dfrac{2}{x^2 - 6x + 8}$

E.5 Radical Equations

Solve:

1. $\sqrt{2x+5} = 7$

2. $\sqrt{3x+1} - \sqrt{x+4} = 1$

Section F Functions and Graphing

F.1 Using Function Notation

1. *For the function* $f(x) = x^2 - 6x + 8$, *find:*

   a) $f(-2)$ b) $f\left(\frac{1}{2}\right)$ c) $f(a-2)$

   d) $f(a+h)$ e) $\dfrac{f(a+h) - f(a)}{h}$

F.2 Domains of Functions

Find the domain for each of the following functions.

1. $f(x) = x^2 - 6x + 8$ 2. $g(x) = \dfrac{1}{6x-7}$ 3. $h(x) = \dfrac{x-2}{\sqrt{1-x}}$

F.3 Linear Functions

Find the equation of the line that satisfies each of the following conditions.

1. Slope of the line is -1 and the line passes through the point $(-7, 4)$.
2. The line passes through the points $(-2, 3)$ and $(5, -6)$. Write your answer in standard form.
3. The line is perpendicular to $y = \frac{3}{4}x - 5$ and passes through the point $(-3, 1)$.
4. The line is parallel to $-2x + 5y = 12$ and passes through the point $(10, -1)$.

F.4 Graphing Functions

Graph each of the following functions. Give the coordinates of all intercepts and any other important points.

1. $y = -3x + 2$
2. $2x + 3y = 12$
3. $f(x) = -2(x+3)^2 + 4$
4. $y = x^2 - 6x + 5$

   Hint: write in form $y = a(x-h)^2 + k$

Section G Systems of Equations

Solve the following systems of equations.

1. $\begin{cases} 4x+3y=4 \\ 6x-5y=-32 \end{cases}$

2. $\begin{cases} \dfrac{x}{2} - \dfrac{y}{3} = 9 \\ -\dfrac{3}{4}x + \dfrac{1}{2}y = 5 \end{cases}$

Section H Trigonometry

H.1 Angles in Standard Position

Sketch each of the following angles in standard position.

1. 215^0
2. -240^0
3. 630^0

H.2 Coterminal Angles

Find one positive and one negative angle coterminal with each of the following angles.

1. 145^0
2. -512^0

H.3 Reference Angles

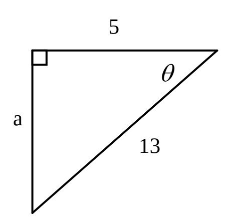
Find the reference angle for each of the following angles.

1. 250^0
2. -745^0

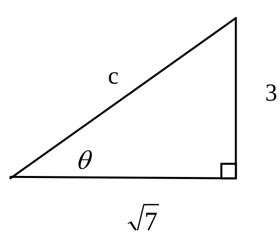
H.4 Trigonometric Ratios

Find the indicated trigonometric ratios for each of the following right triangles.

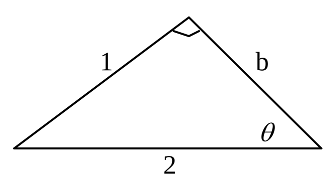
1. $\sin\theta$ and $\sec\theta$



2. $\tan\theta$ and $\csc\theta$



3. $\cos\theta$ and $\cot\theta$



H.5 Finding Trigonometric Values of any Angle

Use your calculator to evaluate the following to three decimal places:

1. $\sin 24.5^0$
2. $\sec\left(121.7^0\right)$

H.6 Finding Exact Trigonometric Values

Use special triangles or the unit circle to find the exact value of each of the following:

1. $\sin\left(240^0\right)$
2. $\sec\left(-135^0\right)$
3. $\tan\left(-270^0\right)$

H.7 Finding Angles Given a Trigonometric Ratio

Use your calculator to find the value of θ in the given interval that satisfies each of the following. Express your answers to nearest tenth of a degree.

1. $\sin\theta = -0.3456 \quad 270^0 \le \theta < 360^0$
2. $\sec\theta = -2.376 \quad 90^0 \le \theta < 180^0$

H.8 Solving Right Triangles

Solve the following right triangle word problem:

1. From a highway overpass, 14.3 meters above the road, the angle of depression of an oncoming car is 18.3^0. How far is the car from a point on the highway directly below the observer? Give your answer to the nearest tenth of a meter.

Solutions

A.1

1. $\dfrac{9-3(5-8)}{|6-11|} = \dfrac{9-15+24}{|-5|} = \boxed{\dfrac{18}{5}}$

2. $-\left\{2-\left[4-(3-5)\right]-(5-2)\right\} = -\left\{2-[6]-(3)\right\} = -\{-7\} = \boxed{7}$

3. $-2^4+\left(-2\right)^3-2^{-2} = -16-8-\dfrac{1}{2^2} = -24-\dfrac{1}{4} = \dfrac{-96}{4}-\dfrac{1}{4} = \boxed{\dfrac{-97}{4} \text{ or } -24\,1/4}$

4. $\dfrac{1}{3^{-1}-4^{-1}} = \dfrac{1}{\frac{1}{3}-\frac{1}{4}} = \dfrac{1}{\frac{1}{12}} = \boxed{12}$

A.2

1. $a^4-2bc = (-2)^4-2(3)(-4) = 16+24 = \boxed{40}$

2. $9xy^2-3xy^{-2} = 9\left(\dfrac{1}{2}\right)\left(-\dfrac{1}{3}\right)^2-3\left(\dfrac{1}{2}\right)\left(-\dfrac{1}{3}\right)^{-2} = 9\left(\dfrac{1}{2}\right)\left(\dfrac{1}{9}\right)-3\left(\dfrac{1}{2}\right)\left(-\dfrac{3}{1}\right)^2 = \dfrac{9}{1}-\dfrac{3}{28}\left(\dfrac{9}{1}\right)=\dfrac{1}{2}-\dfrac{27}{2}=\dfrac{-26}{2}=\boxed{-13}$

3. $\dfrac{(-2)^{-1}+3^{-1}}{(-2)^{-1}-3^{-2}}=\dfrac{-\frac{1}{2}+\frac{1}{3}}{-\frac{1}{2}-\frac{1}{9}}=\dfrac{\frac{-3+2}{6}}{\frac{-9-2}{18}}=\dfrac{-\frac{1}{6}}{-\frac{11}{18}}=\boxed{\dfrac{3}{11}}$

B.1

1. $\left(-3x^5y^{-2}z^0\right)\left(8x^3y\right) = -24x^8y^{-1} = \boxed{\dfrac{-24x^8}{y}}$ (Recall $z^0 = 1$)

2. $\left(\dfrac{a^2b^{-3}c}{2a^{-1}b^{-2}c^3}\right)^{-4} = \left(\dfrac{a^3}{2^1b^1c^2}\right)^{-4} = \dfrac{a^{-12}}{2^{-4}b^{-4}c^{-8}} = \boxed{\dfrac{16b^4c^8}{a^{12}}}$

3. $\dfrac{\left(-\frac{2}{5}ay^{-1}\right)^{-3}}{-4a^5y^{-3}} = \dfrac{\left(-\frac{5}{2}\right)^3a^{-3}y^3}{-4a^5y^{-3}} = \dfrac{-\frac{125}{8}y^6}{-4a^8} = \boxed{\dfrac{125y^6}{32a^8}}$

B.2

1. $\dfrac{x^{\frac{1}{3}}x^{-\frac{5}{3}}}{x^{-\frac{2}{3}}} = x^{\frac{1}{3}-\frac{5}{3}-\left(-\frac{2}{3}\right)} = x^{-\frac{2}{3}} = \boxed{\dfrac{1}{x^{2/3}} = \dfrac{1}{\sqrt[3]{x^2}}}$

2. $\left(x^{\frac{1}{3}}y^{\frac{3}{2}}\right)\left(x^{-\frac{1}{2}}y^{\frac{1}{4}}\right)^2 = \left(x^{\frac{1}{3}}y^{\frac{3}{2}}\right)\left(x^{-1}y^{\frac{1}{2}}\right) = x^{\frac{1}{3}-\frac{3}{3}}y^{\frac{3}{2}+\frac{1}{2}} = x^{-\frac{2}{3}}y^{\frac{4}{2}} = \boxed{\dfrac{y^2}{x^{2/3}} = \dfrac{y^2}{\sqrt[3]{x^2}}}$

3. $\left(\dfrac{2y^{-3/4}}{x^{1/4}y^{-5/4}}\right)^{-2} = \dfrac{2^{-2}y^{(-3/4)(-2)}}{x^{(1/4)(-2)}y^{(-5/4)(-2)}} = \dfrac{y^{3/2}}{4x^{-1/2}y^{5/2}} = \boxed{\dfrac{x^{1/2}}{4y}} = \boxed{\dfrac{\sqrt{x}}{4y}}$

C.1

1. $\sqrt[3]{24}=\sqrt[3]{8\cdot 3}=\boxed{2\sqrt[3]{3}}$

2. $\sqrt{125x^5} = \sqrt{25\cdot 5\cdot x^4\cdot x} = \boxed{5x^2\sqrt{5x}}$

3. $-\sqrt{75x^3y^7} = -\sqrt{25\cdot 3\cdot x^2\cdot x\cdot y^6\cdot y} = \boxed{-5xy^3\sqrt{3xy}}$

4. $\sqrt{18}-\sqrt{50}-3\sqrt{12}-2\sqrt{75} = 3\sqrt{2}-5\sqrt{2}-6\sqrt{3}-10\sqrt{3} = \boxed{-2\sqrt{2}-16\sqrt{3}}$

5. $\left(2+3\sqrt{5}\right)\left(3-7\sqrt{10}\right) = 6-14\sqrt{10}+9\sqrt{5}-21\sqrt{50} = \boxed{6-14\sqrt{10}+9\sqrt{5}-105\sqrt{2}}$

6. $-3\sqrt{48x^3}+7x\sqrt{75x} = -12x\sqrt{3x}+35x\sqrt{3x} = \boxed{23x\sqrt{3x}}$

C.2

1. $\dfrac{2}{\sqrt{12}}=\dfrac{2}{2\sqrt{3}}=\dfrac{1}{\sqrt{3}}\cdot\dfrac{\sqrt{3}}{\sqrt{3}}=\boxed{\dfrac{\sqrt{3}}{3}}$

2. $\left(\dfrac{2}{5-\sqrt{3}}\right)\cdot\left(\dfrac{5+\sqrt{3}}{5+\sqrt{3}}\right) = \dfrac{10+2\sqrt{3}}{25-3} = \dfrac{10+2\sqrt{3}}{22} = \boxed{\dfrac{5+\sqrt{3}}{11}}$

3. $\left(\dfrac{\sqrt{5}-\sqrt{7}}{2\sqrt{5}+\sqrt{7}}\right)\left(\dfrac{2\sqrt{5}-\sqrt{7}}{2\sqrt{5}-\sqrt{7}}\right) = \dfrac{10-\sqrt{35}-2\sqrt{35}+7}{20-7} = \boxed{\dfrac{17-3\sqrt{35}}{13}}$

D.1

1. $3\left[3-2(x-2)-2(3-4x)\right]=3\left[3-2x+4-6+8x\right]=3\left[1+6x\right]=\boxed{18x+3}$

2. $-4(2x-3)^2-(5x-1)(2x+3)=-4\left(4x^2-12x+9\right)-\left(10x^2+13x-3\right)$

   $=-16x^2+48x-36-10x^2-13x+3=\boxed{-26x^2+35x-33}$

3. $(3x-4)\left(7x^2+5x-1\right)=21x^3+15x^2-3x-28x^2-20x+4=\boxed{21x^3-13x^2-23x+4}$

4. $\left(2x^2y^3-3z^2\right)\left(2x^2y^3+3z^2\right)=\boxed{4x^4y^6-9z^4}$

3. $6x^2+26x-20=2\left(3x^2+13x-10\right)=\boxed{2(3x-2)(x+5)}$

D.2

1. $100x^2-81=\boxed{(10x-9)(10x+9)}$

2. $x^2-7x+12=\boxed{(x-3)(x-4)}$

3. $6x^2+26x-20=2\left(3x^2+13x-10\right)=\boxed{2(3x-2)(x+5)}$

4 $(x+3)(x-1)^2+(x+5)(x-1)^3=(x-1)^2\left[(x+3)\ +\ (x+5)(x-1)\right]$

$=(x-1)^2\left[x+3+x^2+4x-5\right]$

$=\boxed{(x-1)^2\left(x^2+5x-2\right)}$

5. $x^2y^2+ab-ay^2-bx^2\ =\ x^2y^2-ay^2-bx^2+ab$

$=y^2\left(x^2-a\right)-b\left(x^2-a\right)$

$=\boxed{\left(x^2-a\right)\left(y^2-b\right)}$

D.3

1. $\dfrac{2x^2-8}{x^2-4x+4}=\dfrac{2\left(x^2-4\right)}{(x-2)^2}=\dfrac{2(x-2)(x+2)}{(x-2)^2}=\boxed{\dfrac{2(x+2)}{x-2}}$

2. $\dfrac{x^2-5x-6}{x^2-6x}\cdot\dfrac{6}{12x+12}=\dfrac{(x-6)(x+1)}{x(x-6)}\cdot\dfrac{6}{12(x+1)}=\boxed{\dfrac{1}{2x}}$

3. $\dfrac{4}{x+2}+\dfrac{2}{2-x}+\dfrac{1}{x^2-4}=\dfrac{4}{x+2}-\dfrac{2}{x-2}+\dfrac{1}{(x+2)(x-2)}$

$=\dfrac{4(x-2)-2(x+2)+1}{(x+2)(x-2)}$

$=\dfrac{4x-8-2x-4+1}{(x+2)(x-2)}$

$=\boxed{\dfrac{2x-11}{(x+2)(x-2)}}$

4. $\dfrac{2}{x^2-3x+2}+\dfrac{6}{x^2-1}=\dfrac{2}{(x-2)(x-1)}+\dfrac{6}{(x-1)(x+1)}=\dfrac{2(x+1)+6(x-2)}{(x-2)(x-1)(x+1)}=\boxed{\dfrac{8x-10}{(x-2)(x-1)(x+1)}}$

D.4

1. $$\frac{21x^3-35x^2+14x-7}{7x}$$
$$=\frac{21x^3}{7x}-\frac{35x^2}{7x}+\frac{14x}{7x}-\frac{7}{7x}$$
$$=\boxed{3x^2-5x+2-\frac{1}{x}}$$

2. $$\begin{array}{r} x^2-2x+4 \\ 3x+1\overline{\big)\,3x^3-5x^2+10x-3} \\ -\left(3x^3+x^2\right) \\ \hline -6x^2+10x \\ -\left(-6x^2-2x\right) \\ \hline 12x-3 \\ -\left(12x+4\right) \\ \hline -7 \end{array}$$

$Q(x)=x^2-2x+4$

$R(x)=-7$

E.1

1. $$\frac{5}{2}x-7=18$$
$$5x-14=36$$
$$5x=50$$
$$\boxed{x=10}$$

2. $$\frac{7}{5}(x-1)-\frac{3}{2}(x-2)=1 \qquad \text{LCD } =10$$
$$10\cdot\frac{7}{5}(x-1)\ -\ 10\cdot\frac{3}{2}(x-2)\ =\ 1\cdot 10$$
$$14(x-1)-15(x-2)=10$$
$$14x-14-15x+30=10$$
$$-x=-6$$
$$\boxed{x=6}$$

3. $6w-5d+7h=80$ for w
$$6w=5d-7h+80$$
$$w=\boxed{\frac{5d-7h+80}{6}}$$

4. $a=\frac{3}{b}(b-y)$ for b
$$ab=3b-3y$$
$$3y=3b-ab$$
$$3y=b(3-a)$$
$$\boxed{b=\frac{3y}{3-a}}$$

E.2

1. $$2x^2=14x$$
$$2x^2-14x=0$$
$$2x(x-7)=0$$
$$\boxed{x=0,7}$$

2. $3x^2=5x-1 \Rightarrow 3x^2-5x+1=0$

Can't factor; use quadratic formula.

$$x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}\ ;\ a=3,\ b=-5,\ c=1$$
$$x=\frac{5\pm\sqrt{(-5)^2-4\cdot 3\cdot 1}}{2\cdot 3}$$
$$\boxed{x=\frac{5\pm\sqrt{13}}{6} \quad \text{or} \quad x=1.434,0.232}$$

3. $3x^2-4x-1=0$ Want leading coefficient to be 1

$$\frac{x^2}{3}-\frac{4}{3}x-\frac{1}{3}=\frac{0}{3}$$

$$x^2-\frac{4}{3}x=\frac{1}{3} \qquad \left\langle \frac{1}{2}\left(\frac{4}{3}\right)=\frac{2}{3}\Rightarrow\left(\frac{2}{3}\right)^2=\frac{4}{9}\right\rangle$$

$$x^2-\frac{4}{3}x+\boxed{\frac{4}{9}}=\frac{1}{3}+\boxed{\frac{4}{9}}$$

$$\left(x-\frac{2}{3}\right)^2=\frac{7}{9}$$

$$x-\frac{2}{3}=\pm\frac{\sqrt{7}}{3}\Rightarrow\boxed{x=\frac{2\pm\sqrt{7}}{3}}$$

E.3

1.
$$8-3x\le 2$$
$$-3x\le -6$$
$$x\ge 2$$
Interval notation: $[2,\infty)$

2. $-\frac{1}{2}\le\frac{3-2x}{2}<\frac{5}{4}$ ⟨Clear denominators⟩
$$-2\le 2(3-2x)<5$$
$$-2\le 6-4x<5$$
$$-8\le -4x<-1$$
$$2\ge x>\frac{1}{4}$$
$$\frac{1}{4}<x\le 2$$
Interval notation: $\left(\frac{1}{4},2\right]$

E.4

1. $\frac{8}{y}-\frac{1}{3}=\frac{5}{y}$ LCD $=3y$; $y\ne 0$
$$\frac{8}{y}\cdot 3y-\frac{1}{3}\cdot 3y=\frac{5}{y}\cdot 3y$$
$$24-y=15$$
$\boxed{y=9}$ Checks

2. $\frac{x}{x-2}+\frac{1}{x-4}=\frac{2}{x^2-6x+8}$ LCD=$(x-4)(x-2)$; $x\ne 2,4$
$$\frac{x}{x-2}+\frac{1}{x-4}=\frac{2}{(x-4)(x-2)}$$
$$(x-4)\cancel{(x-2)}\cdot\frac{x}{\cancel{x-2}}+\cancel{(x-4)}(x-2)\cdot\frac{1}{\cancel{x-4}}=\frac{2}{\cancel{(x-4)(x-2)}}\cancel{(x-4)(x-2)}$$
$$x(x-4)+(x-2)=2$$
$$x^2-4x+x-2=2$$
$$x^2-3x-4=0$$
$$(x-4)(x+1)=0$$
$x=-1,4$ Note: 4 is a restricted value

$\boxed{x=-1}$

E.5

1. $(\sqrt{2x+5})^2 = 7^2$
$$2x+5=49$$
$$2x=44$$
$$\boxed{x=22 \quad \text{Checks}}$$

2. $\sqrt{3x+1}-\sqrt{x+4}=1$
$$(\sqrt{3x+1})^2=(1+\sqrt{x+4})^2$$
$$3x+1=1+2\sqrt{x+4}+x+4$$
$$(2x-4)^2=\left(2\sqrt{x+4}\right)^2$$
$$4x^2-16x+16=4(x+4)$$
$$4x^2-16x+16=4x+16$$
$$4x^2-20x=0$$
$$4x(x-5)=0$$
$$x=0 \quad \text{or} \quad x=5$$
$\boxed{x=5}$ since $x=0$ does not check.

F.1

1. $f(x)=x^2-6x+8$
$$f(-2)=(-2)^2-6(-2)+8$$
$$=4+12+8$$
$$\boxed{=24}$$

2. $f(x)=x^2-6x+8$
$$f\left(\frac{1}{2}\right)=\left(\frac{1}{2}\right)^2-6\left(\frac{1}{2}\right)+8=\frac{1}{4}-3+8$$
$$\boxed{f\left(\frac{1}{2}\right)=\frac{21}{4}=5.25}$$

3. $f(x)=x^2-6x+8$
$$f(a-2)=(a-2)^2-6(a-2)+8$$
$$=a^2-4a+4-6a+12+8$$
$$=a^2-10a+24$$

4. $f(x)=x^2-6x+8$
$$f(a+h)=(a+h)^2-6(a+h)+8$$
$$=a^2+2ah+h^2-6a-6h+8$$
$$=a^2+2ah-6a+h^2-6h+8$$

5. $f(x)=x^2-6x+8$
$$\frac{f(a+h)-f(a)}{h}=\frac{(a+h)^2-6(a+h)+8-\left(a^2-6a+8\right)}{h}$$
$$=\frac{a^2+2ah+h^2-6a-6h+8-a^2+6a-8}{h}$$
$$=2a+h-6$$

F.2

1. $f(x)=x^2-6x+8$
Domain: $\{x | x \in \text{ Reals}\}$

2. $g(x)=\dfrac{1}{6x-7}$
Domain: $\{x | x \neq 7/6\}$

3. $h(x)=\dfrac{x-2}{\sqrt{1-x}}$
Need $1-x>0$
$$-x>-1$$
$$x<1$$
Domain: $\{x | x<1\}$ or $(-\infty,1)$

F.3

1. $m = -1$; point $(-7, 4)$; $y = mx + b$

   $4 = -1(-7) + b \Rightarrow b = -3,$

   $\therefore \boxed{y = -x - 3}$ or $\boxed{x + y = -3}$

2. $m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-6 - 3}{5 - (-2)} = \boxed{-\dfrac{9}{7}}$

   Using point-slope form:

   $y - y_1 = m(x - x_1) \Rightarrow y - 3 = -\dfrac{9}{7}(x + 2)$

   $7y - 21 = -9x - 18 \Rightarrow \boxed{9x + 7y = 3}$

3. $m = \dfrac{3}{4}, \quad m_{\perp} = -\dfrac{4}{3}, \quad (-3, 1)$

   $y = mx + b \Rightarrow 1 = \left(-\dfrac{4}{3}\right)(-3) + b$

   $b = -3, \quad \Rightarrow \quad \therefore \boxed{y = -\dfrac{4}{3}x - 3}$

4. $m = \dfrac{2}{5}, \ (10, -1)$

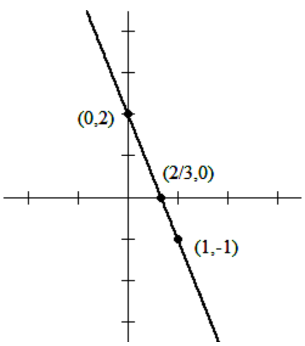
   $y = mx + b \Rightarrow -1 = \left(\dfrac{2}{5}\right)(10) + b$

   $b = -5, \quad \Rightarrow \quad \therefore \boxed{y = \dfrac{2}{5}x - 5}$

F.4

1. $y = -3x + 2$

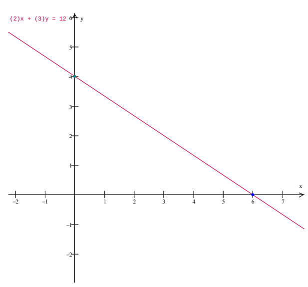
   $m = -3, \ (0, 2), \ \left(\frac{2}{3}, 0\right)$



2. $2x + 3y = 12$

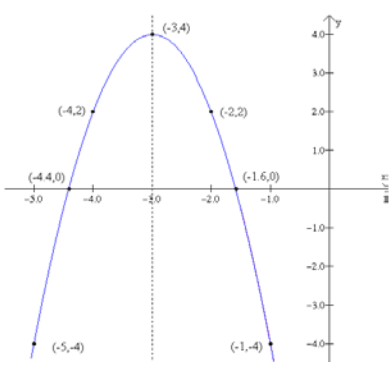
   For x int, set $y = 0$: $2x + 3(0) = 12 \Rightarrow x = 6 \quad (6, 0)$

   For y int, set $x = 0$: $2(0) + 3y = 12 \Rightarrow y = 4 \quad (0, 4)$



3. $f(x) = -2(x + 3)^2 + 4$, Vertex: $(-3, 4)$, opens downward

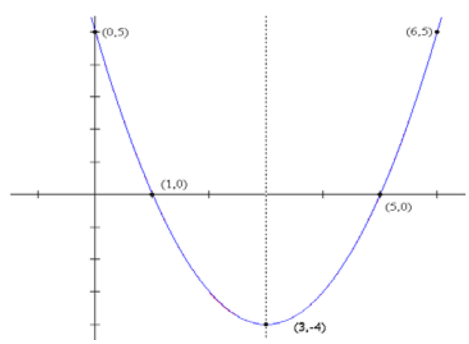
   intercepts: $(0, -14)$, $(-4.4, 0)$, $(-1.6, 0)$



4. $y = x^2 - 6x + 5 \Rightarrow y = \left(x^2 - 6x + \boxed{9}\right) - \boxed{9} + 5$

   $y = (x - 3)^2 - 4$, Vertex: $(3, -4)$, opens upward

   intercepts: $(0, 5)$, $(1, 0)$, $(5, 0)$



G.1

1.

$$\begin{cases} 4x+3y=4 & \times 3 \\ 6x-5y=-32 & \times(-2) \end{cases}$$

$$\begin{cases} 12x+9y=12 \\ -12x+10y=64 \end{cases}$$

$$19y=76 \quad \text{or} \quad y=4$$

Sub into eq 1: $4x+3(4)=4$

$$4x=-8$$

$$x=-2$$

$\boxed{\text{Solution: } (-2,4)}$

2.

$$\begin{cases} \dfrac{x}{2}-\dfrac{y}{3}=9 & \times 6 \\ -\dfrac{3}{4}x+\dfrac{1}{2}y=5 & \times 4 \end{cases}$$

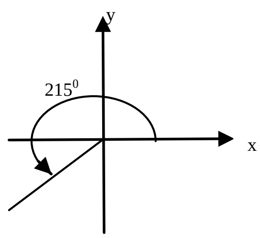
$$\begin{cases} 3x-2y=54 \\ -3x+2y=20 \end{cases}$$

$0+0=74$ false!

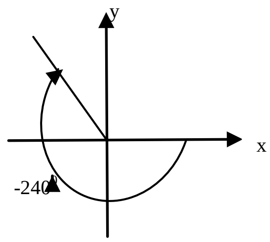
Conclusion: There are no solutions.

(The two lines are parallel and so do not intersect.)

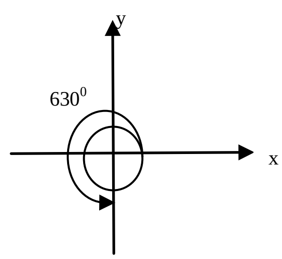
H.1



1.



2.



3.

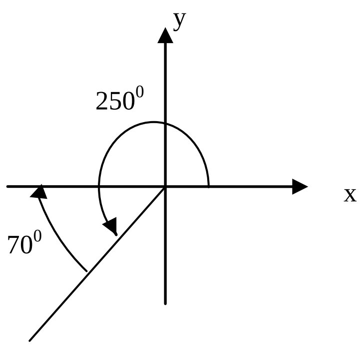
H.2

1. 145^0 Coterminal: $145^0 + 360^0 = 505^0$
$145^0 - 360^0 = -215^0$

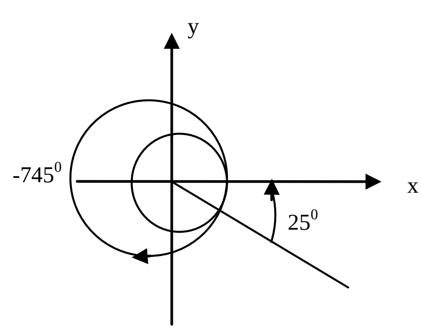
2. -512^0 Coterminal: $-512^0 + 360^0 = -152^0$
$-152^0 + 360^0 = 208^0$

H.3

1. Reference angle for 250^0 is 70^0.



2. For -745^0, the reference angle is 25^0.



H.4

1. Use Pythagoras to find "a"

$a^2 = 13^2 - 5^2 \Rightarrow a^2 = 144; \therefore a = 12.$

So $\boxed{\sin\theta = \frac{12}{13}}$ and $\boxed{\sec\theta = \frac{13}{5}}$

2. Use Pythagoras to find "a"

$c^2 = 3^2 + \left(\sqrt{7}\right)^2 \Rightarrow c^2 = 16; \therefore c = 4.$

$\boxed{\tan\theta = \frac{3}{\sqrt{7}} = \frac{3\sqrt{7}}{7}}$ and $\boxed{\csc\theta = \frac{4}{3}}$

3. $2^2 = 1^2 + b^2 \Rightarrow b^2 = 3; \therefore b = \sqrt{3},$ $\boxed{\cos\theta = \frac{\sqrt{3}}{2}}$ and $\boxed{\cot\theta = \frac{\sqrt{3}}{1} = \sqrt{3}}$

H.5

1. $\sin 24.5° = \boxed{0.415}$

2. $\sec 121.7° = \frac{1}{\cos 121.7°} = \boxed{-1.903}$

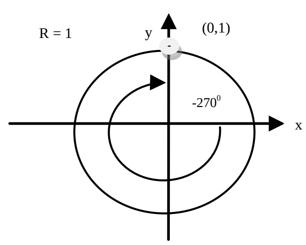
H.6

1. $\sin 240^0 = -\sin 60^0 = \boxed{-\frac{\sqrt{3}}{2}}$

2. $\sec\left(-135^0\right) = -\sec 45^0 = \boxed{-\sqrt{2}}$

3. $\tan\left(-270^0\right)$, -270^0 is a quadrantal angle; use the unit circle.

$\tan\left(-270^0\right) = \frac{y}{x}$; since $x = 0$, $\tan\left(-270^0\right)$ is $\boxed{\text{undefined}}$. .



H.7

1. $\sin\theta = -0.3456$

θ lies in quadrant IV, reference angle $= \sin^{-1}\left(0.3456\right) \sim 20.2^0$,

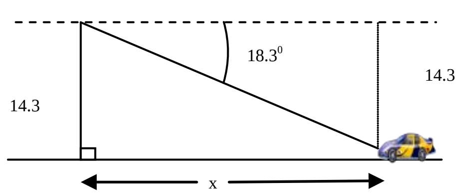
$\theta = 360^0 - 20.2^0 = \boxed{339.8^0}$

2. $\sec\theta = -2.376$ *or* $\cos\theta = -\frac{1}{2.376}$

, θ lies in quadrant II, reference angle $= \cos^{-1}\left(\frac{1}{2.376}\right) \sim 65.1^0$,

$\theta = 180^0 - 65.1^0 = \boxed{114.9^0}$

H.8



$\tan 18.3^0 = \frac{14.3}{x} \Rightarrow x = \frac{14.3}{\tan 18.3^0} \sim 43.239.$

The car is about $\boxed{\text{43 meters}}$ from a point on the highway directly below the observer.