1) Melissa regularly mows the lawn of the courthouse using a push mower and has determined it takes her 5 hours. One time her father helped her and they completed the job together in 1.5 hours. Approximate to the nearest tenth of an hour how long it would take Melissa's father to mow the courthouse lawn by himself.

A 2.0 *hours*
B 2.1 *hours*
C 2.3 *hours*
D 2.5 *hours*
E 3.0 *hours*

x = time for father to mow lawn by himself

Melissa's rate: $\frac{1}{5}$ Father's rate: $\frac{1}{x}$

$\text{part}_{Mellissa} + \text{part}_{father} = 1$

$r_M t_M + r_F t_F = 1$

$\left(\frac{1}{5}\right)(1.5) + \left(\frac{1}{x}\right)(1.5) = 1$

$\frac{1.5}{5} + \frac{1.5}{x} = 1$

$LCD = 5x$

$5x\left(\frac{1.5}{5} + \frac{1.5}{x}\right) = 5x(1)$

$1.5x + 7.5 = 5x$

$7.5 = 3.5x$

$2.1 \approx x$

2) Multiply where *i* is the imaginary unit. Write answer in *a* + *bi* (standard) form.

$(14 - 11i)(-2 - 2i)$

A $-50 + 6i$
B $12 - 13i$
C $-28 + 16i$
D $-28 - 28i$
E $-50 - 6i$

$(14 - 11i)(-2 - 2i)$ *FOIL*

$= -28 - 28i + 22i + 22i^2 \quad (i^2 = -1)$

$= -28 - 6i + 22(-1)$

$= -28 - 6i - 22$

$= -50 - 6i$

3) Solve the equation. $6x^2 + 25 = 25x$

A $x = \frac{5}{6},\ x = 5$
B $x = -\frac{5}{2},\ x = \frac{5}{3}$
C $x = \frac{5}{2}i,\ x = \frac{5}{3}i$
D $x = \frac{5}{2},\ x = \frac{5}{3}$
E $x = -\frac{5}{6},\ x = -5$

Set equation to zero: $6x^2 - 25x + 25 = 0$
Either factoring or the quadratic formula may be used.
Product: 150 Sum: -25 Numbers are -10 and -15

$\underline{6x^2 - 15x}\ \underline{-10x + 25} = 0$

$\underline{3x(2x-5)}\ \underline{-5(2x-5)} = 0$

$(2x-5)(3x-5) = 0$

$2x - 5 = 0 \qquad 3x - 5 = 0$

$2x = 5 \qquad 3x = 5$

$x = \frac{5}{2} \qquad x = \frac{5}{3}$

$$x=\frac{25\pm\sqrt{25^2-4(6)(25)}}{2(6)}=\frac{25\pm\sqrt{625-600}}{12}=\frac{25\pm\sqrt{25}}{12}$$

$$x=\frac{25\pm5}{12} \qquad x=\frac{25+5}{12}=\frac{30}{12}=\frac{5}{2}$$

$$x=\frac{25-5}{12}=\frac{20}{12}=\frac{5}{3}$$

4) Find **one** of the solutions of $(x+1)^2=6$.

A $x=-1-\sqrt{6}$

B $x=\sqrt{6}$

C $x=\sqrt{6}-1$

D $x=1-\sqrt{6}$

E None of the above.

This equation is in the 'format' to use the square root property.

$(x+1)^2=6$

$x+1=\pm\sqrt{6}$

$x+1=\sqrt{6} \qquad x+1=-\sqrt{6}$

$x=-1+\sqrt{6} \qquad x=-1-\sqrt{6}$

The left could be FOILed, equation set to zero and the quadratic formula used too.

$(x+1)(x+1)=6$

$x^2+x+x+1=6$

$x^2+2x-5=0$

$$x=\frac{-2\pm\sqrt{2^2-4(1)(-5)}}{2(1)}=\frac{-2\pm\sqrt{24}}{2}$$

$$x=\frac{-2}{2}\pm\frac{\sqrt{4\cdot6}}{2}=-1\pm\frac{2\sqrt{6}}{2}=-1\pm\sqrt{6}$$

5) A right triangle is shown with its two shorter sides represented using an *x*. Which **simplified equation** could be used to find the length of the side labeled *x*?

A $5x^2-308=0$

B $5x^2+9x+317=0$

C $5x^2+9x-308=0$

D $10x^2+9x-616=0$

E $4x+3=25$

Pythagorean Theorem:

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

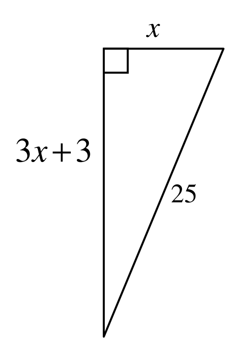
$x^2+(3x+3)^2=25^2$

$x^2+9x^2+9x+9x+9=625$

$10x^2+18x-616=0$

$2(5x^2+9x-308)=0$

$5x^2+9x-308=0$



6) A toy rocket is launched from a rooftop 32 feet high. Its distance is given by the model $h = -16t^2 + 208t + 32$, where h is height above the ground in feet and t is time in seconds. In how many seconds is the toy rocket 452 feet from the ground? Round to the nearest tenth of a second, if necessary.

A 2.0 and 11.0 seconds after launch

B 14.8 seconds only after launch

C 2.5 and 10.5 seconds after launch

D 13.2 seconds only after launch

E Never, that is too high for the rocket to reach

$452 = -16t^2 + 208t + 32$

$16t^2 - 208t + 420 = 0$

$4(4t^2 - 52t + 105) = 0$

$$t = \frac{52 \pm \sqrt{52^2 - 4(4)(105)}}{2(4)} = \frac{52 \pm \sqrt{2704 - 1680}}{8}$$

$$t = \frac{52 \pm \sqrt{1024}}{8} = \frac{52 \pm 32}{8}$$

$$t = \frac{52+32}{8} = \frac{84}{8} = 10.5$$

$$t = \frac{52-32}{8} = \frac{20}{8} = 2.5$$

7) Solve the equation.

$$\sqrt{5x+6} = x+2$$

A $x = -1$

B $x = \frac{5}{2} + \frac{\sqrt{33}}{2}$

C $x = 2$

D $x = 2$ and $x = -1$

E $x = \frac{5}{2} - \frac{\sqrt{33}}{2}$

Square both sides. Remember to FOIL on the right.

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

$5x+6 = (x+2)(x+2)$

$5x+6 = x^2 + 2x + 2x + 4$

$0 = x^2 - x - 2$

$0 = (x-2)(x+1)$

$x - 2 = 0 \quad x + 1 = 0$

$x = 2 \quad x = -1$

Checks:

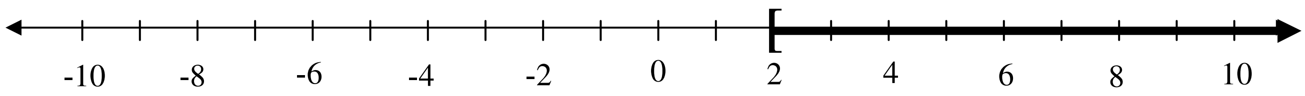
$\sqrt{5(2)+6} = 2+2 \qquad \sqrt{5(-1)+6} = -1+2$

$\sqrt{16} = 4$ *True* $\qquad \sqrt{1} = 1$ *True*

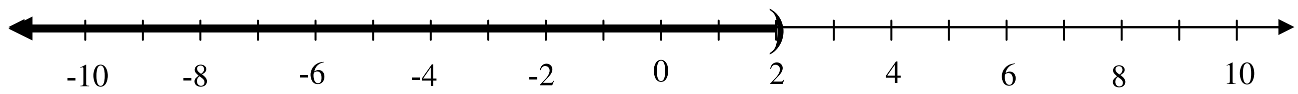
8) Solve the inequality below. Which choice correctly represents the solution?

$$\frac{3}{2}x+\frac{1}{3} \geq -\frac{1}{3}(x-12)$$

A



B



C $(2,\infty)$

D $(-\infty,-2)$

E None of the above.

$LCD=6$

$6\left(\frac{3}{2}x+\frac{1}{3}\right)\geq 6\left(-\frac{1}{3}(x-12)\right)$

$9x+2\geq -2(x-12)$

$9x+2\geq -2x+24$

$11x+2\geq 24$

$11x\geq 22$

$x\geq 2$

The correct graph should be shaded in the greater than direction and have a bracket on the 2.

9) Solve: $|3x-6|\geq 12$

A $[-2,6]$

B $[6,\infty)$

C $(-\infty,-6)\cup(2,\infty)$

D $[-6,2]$

E $(-\infty,-2]\cup[6,\infty)$

The numbers where absolute value is greater than or equal to 12 are found in two rays in opposite directions away from -12 and 12.

-12 12

$3x-6\leq -12$ or $3x-6\geq 12$

$3x\leq -6$ $3x\geq 18$

$x\leq -2$ $x\geq 6$

$(-\infty,-2]\cup[6,\infty)$

10) Find the exact distance between points $(2,-5)$ and $(10,10)$. Then, find the coordinates of the midpoint M of the two points.

A $d=17$, $M\left(4,\frac{15}{2}\right)$

B $d=\sqrt{161}$, $M\left(6,\frac{5}{2}\right)$

C $d=13$, $M\left(\frac{5}{2},6\right)$

D $d=23$, $M\left(4,\frac{15}{2}\right)$

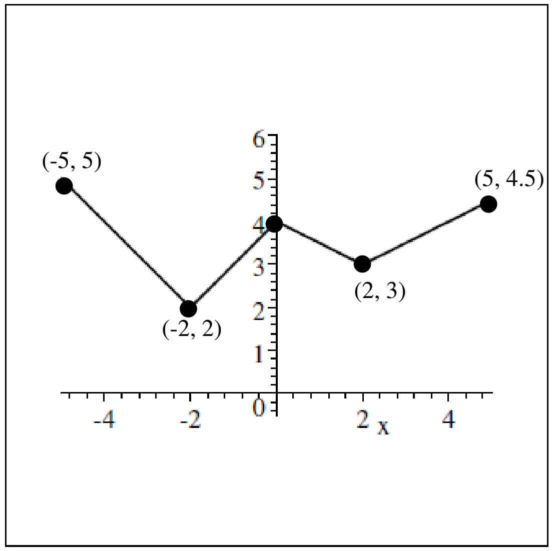
E $d=17$, $M\left(6,\frac{5}{2}\right)$

$$d=\sqrt{(10-2)^2+(10-(-5))^2}$$
$$d=\sqrt{8^2+15^2}=\sqrt{64+225}=\sqrt{289}$$
$$d=17$$

$$M\left(\frac{2+10}{2},\frac{-5+10}{2}\right)\to\left(\frac{12}{2},\frac{5}{2}\right)\to\left(6,\frac{5}{2}\right)$$

11) Which statement(s) is(are) **true** about the graph?

I	The domain is $[-5,5]$.
II	There is a relative miminum of 3 when $x=2$.
III	The graph is increasing on $(2,5)$.



A I, II, and III

B II and III only

C I and II only

D I only

E I and III only

I is true. From x of the most left point to x of the most right point is -5 to 5.

II is true. The point (2, 3) is relatively low compared to points around it. The minimum value is 3 when $x = 2$.

III is true. From an x value of 2 to an x value of 5, the graph is 'rising'.

12) Find the slope of the line with points $(5,-2)$ and $(1,1)$.

A $-\dfrac{1}{6}$

B $-\dfrac{3}{4}$

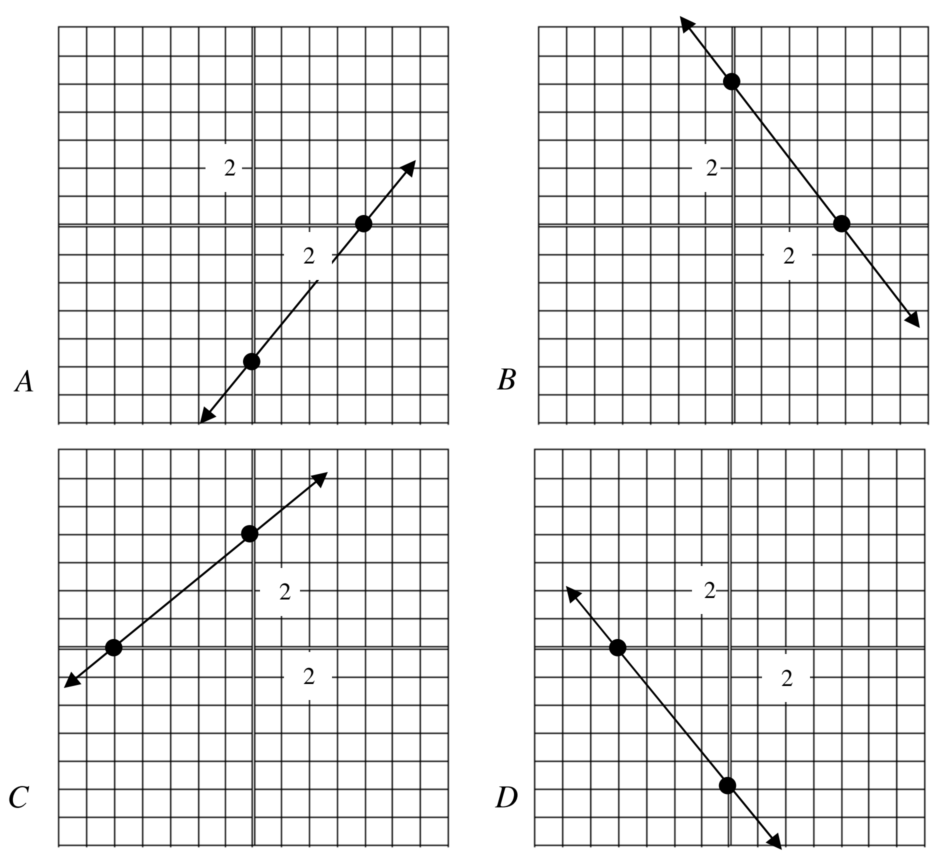
C $-\dfrac{1}{4}$

D $-\dfrac{4}{3}$

E None of the above.

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{1-(-2)}{1-5}=\frac{3}{-4}=-\frac{3}{4}$$

13) Find the intercepts of the line with equation $5x-4y=20$ and use them to graph the line. Choose the correct graph.



E None of the above.

Let $x=0$ and $y=0$.

$-4y=20$ y-intercept is -5

$5x=20$ x-intercept is 4

Correct graph is A.

14) Given the function $f(x)=\begin{cases}3x-1 & \text{if } x<2\\ \dfrac{x+1}{3} & \text{if } x\geq 2\end{cases}$, evaluate $f(2)$ and $f(-5)$.

A $f(2)=5,\quad f(-5)=-16$

B $f(2)=1,\quad f(-5)=-16$

C $f(2)=5,\quad f(-5)=14$

D $f(2)=1,\quad f(-5)=-\frac{4}{3}$

E None of the above.

$x=2$ is in the domain $x\geq 2$

$f(2)=\dfrac{2+1}{3}=\dfrac{3}{3}=1$

$x=-5$ is in the domain $x<2$

$f(-5)=3(-5)-1=-15-1=-16$

15) Which of the equations below represents a line through the point $(-9,2)$ and perpendicular to the line with equation $y=-5x+7$? Write equation in general form.

A $x+5y-1=0$

B $5x+y+43=0$

C $x-5y+10=0$

D $x-5y+19=0$

E None of the above.

The slope of the given line is -5. Any perpendicular line's slope would be $\dfrac{1}{5}$.

$Slope: m=\dfrac{2}{5}$

$y-y_1=m(x-x_1)$

$y-2=\dfrac{1}{5}(x-(-9))$

$5(y-2)=1(x+9)$

$5y-10=x+9$

$0=x-5y+19$