

You will have 2 hours to complete this exam. You may use a calculator (TI-84 or lower, no cell phones) but must show all algebraic work in the space provided to receive full credit. Read all directions carefully, simplify all answers fully, and clearly indicate your answer. Good Luck!

Factor Completely. If the polynomial is prime, say so. (2pts each)

1. $3x^2 - 10x + 8$

$$3x^2 - 6x - 4x + 8$$

$$3x(x-2) - 4(x-2)$$

$$\boxed{(3x-4)(x-2)}$$

2. $3x^3 - 12x^2 + 9x$

$$3x(x^2 - 4x + 3)$$

$$\boxed{3x(x-3)(x-1)}$$

Perform the indicated operation and simplify completely. Leave complex answers in the form $a + bi$, rationalize all denominators. (3 pts each)

3. $\frac{7x-14}{x^2-4} \cdot \frac{5x^2+6x+1}{35x+7}$

$$\frac{\cancel{7}(x-2)}{(x+2)\cancel{(x-2)}} \cdot \frac{(5x+1)\cancel{(x+1)}}{\cancel{7}(5x+1)}$$

$$\boxed{\frac{(x+1)}{(x+2)}}$$

4. $\frac{x}{x-7} + \frac{2x}{7-x}$

$$\frac{x}{x-7} + \frac{-2x}{x-7}$$

$$\boxed{\frac{-x}{x-7}} \quad \text{or} \quad \frac{x}{7-x}$$

5. $\frac{x}{x^2+5x+6} - \frac{2}{x^2+3x+2}$

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

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

$$\frac{x^2+x-2x-6}{(x+1)(x+2)(x+3)} = \frac{x^2-x-6}{(x+1)(x+2)(x+3)}$$

$$= \frac{(x-3)\cancel{(x+2)}}{(x+1)\cancel{(x+2)}(x+3)} = \boxed{\frac{x-3}{(x+1)(x+3)}}$$

6. $\sqrt[4]{32x^5y^4}$

$$\sqrt[4]{2^5x^5y^4}$$

$$\boxed{2xy\sqrt[4]{2x}}$$

Perform the indicated operation and simplify completely. Leave complex answers in the form $a + bi$, rationalize all denominators. (3pts each)

7. $\sqrt{\frac{16}{5}}$

$$\frac{\sqrt{16}}{\sqrt{5}} = \frac{4\sqrt{5}}{\sqrt{5}\sqrt{5}} = \boxed{\frac{4\sqrt{5}}{5}}$$

8. $3\sqrt{45} + 8\sqrt{20}$

$$\begin{aligned} & 3\sqrt{9 \cdot 5} + 8\sqrt{4 \cdot 5} \\ & 3 \cdot 3\sqrt{5} + 8 \cdot 2\sqrt{5} \\ & 9\sqrt{5} + 16\sqrt{5} \\ & = \boxed{25\sqrt{5}} \end{aligned}$$

9. $(2 - \sqrt{3})(3 - \sqrt{3})$

$$\begin{aligned} & 6 - 2\sqrt{3} - 3\sqrt{3} + 3 \\ & \boxed{9 - 5\sqrt{3}} \end{aligned}$$

10. $(4 - 3\sqrt{2}) + (2 + 3\sqrt{2})$

$$\boxed{2}$$

11. $(3 + 3i)(4 - 3i)$

$$\begin{aligned} & 12 - 9i + 12i - 9i^2 \\ & 12 + 3i + 9 \\ & \boxed{21 + 3i} \end{aligned}$$

12. $\frac{5}{(2-i)} \cdot \frac{(2+i)}{(2+i)}$

$$\begin{aligned} & = \frac{10 + 5i}{4 + 2i - 2i - i^2} \\ & = \frac{10 + 5i}{5} = \boxed{2 + i} \end{aligned}$$

List any restrictions on the domain of each function below (1pt each)

13. $f(x) = x^2 - 3x + 10$

no restrictions
Domain $(-\infty, \infty)$

14. $f(x) = \frac{2x-3}{x^2-5x+6}$

$x^2 - 5x + 6 = 0$
 $(x-3)(x-2) = 0$
 $x = 3$ or $x = 2$

restrictions at
 $x = 3, x = 2$

15. $f(x) = \sqrt{2x+3}$

$2x+3 \geq 0$

$2x \geq -3$

$x \geq -3/2$

restrictions;

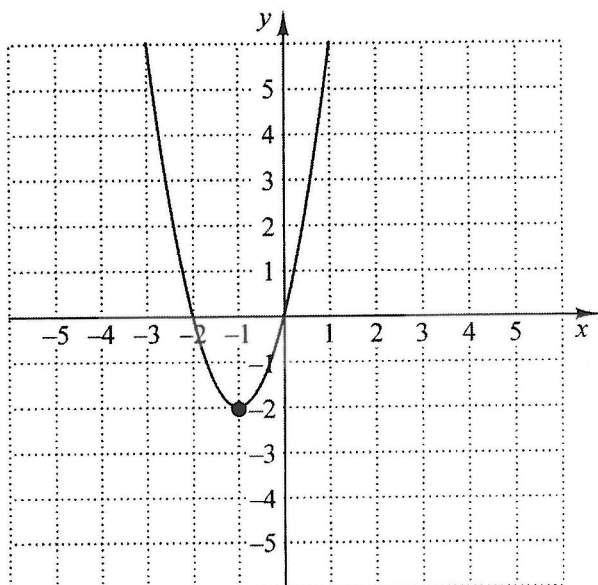
x cannot be less than $-3/2$

Domain $[-3/2, \infty)$

16. (2pts) Given $f(x) = x^2 - 3x + 5$, find $f(-2)$

$f(-2) = (-2)^2 - 3(-2) + 5$
 $= 4 + 6 + 5 = \boxed{15}$

17. Use the graph of the function below to determine the following: (2pts each)



What is the minimum value of the function? -2

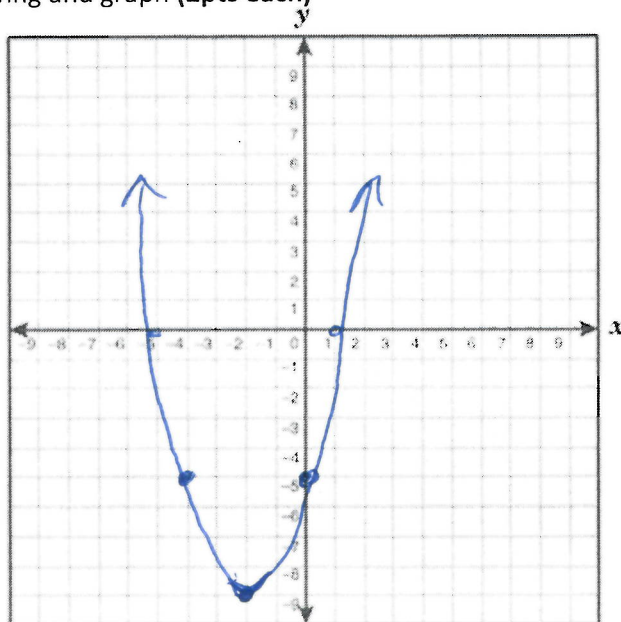
What is the range of the function? $[-2, \infty)$

What are the zeros of the function? -2, 0

18. For the quadratic function $f(x) = x^2 + 4x - 5$, find the following and graph (2pts each)

- a. Vertex $(-2, -9)$
 $-\frac{4}{2} = -2$ $f(-2) = 4 - 8 - 5 = -9$
- b. x-intercept(s) $(-5, 0), (1, 0)$
 $(x+5)(x-1) = 0$
 $x = -5, x = 1$
- c. y-intercept $(0, -5)$

d. Graph to the right



Match the graph to the type of function that best describes it. The same type may be used multiple times. (2pts each)

(a) : Linear

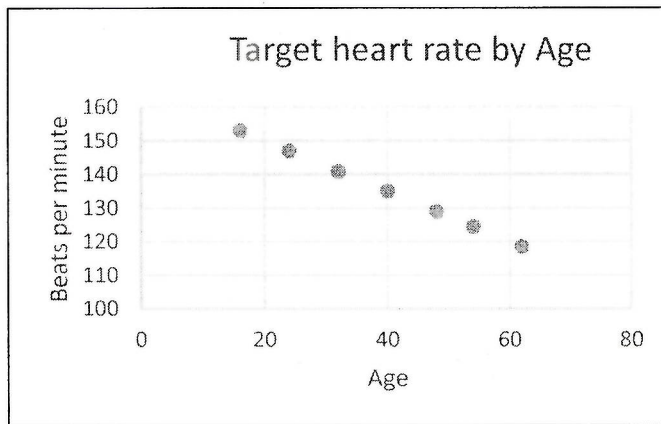
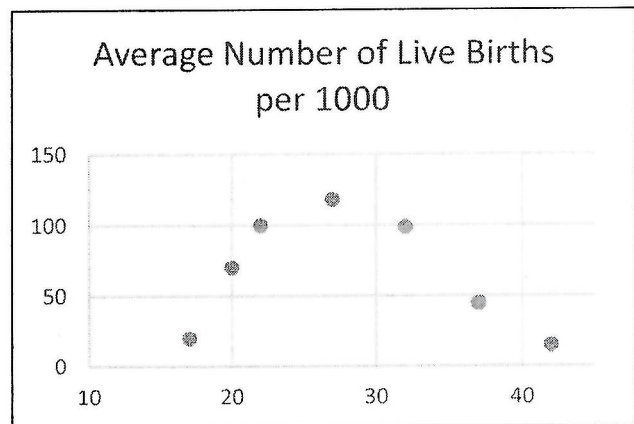
(b) : Quadratic

(c) : Exponential

(d) : Radical

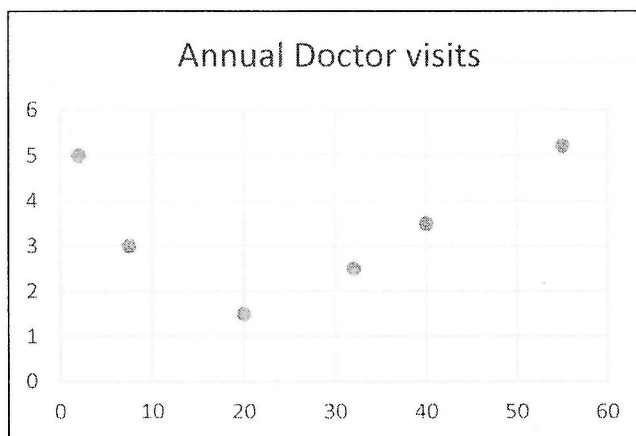
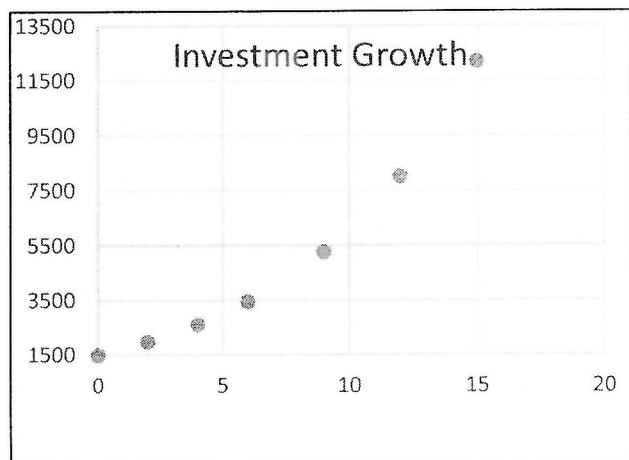
19. Quadratic

20. Linear



21. Exponential

22. Quadratic



Solve each equation below. Simplify completely, do not round. (3 pts each)

23. $6x - 12x^2 = 0$

$$6x(1-2x) = 0$$

$$6x = 0 \text{ or } 1-2x = 0$$

$$\boxed{x = 0 \text{ or } x = \frac{1}{2}}$$

24. $\frac{2}{x-2} + \frac{1}{x+4} = \frac{x}{x^2+2x-8}$

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

$$2(x+4) + 1(x-2) = x$$

$$2x+8+x-2 = x$$

$$2x = -6$$

$$\boxed{x = -3}$$

25. $3 + \sqrt{5-x} = x$

$$(\sqrt{5-x})^2 = (x-3)^2$$

$$5-x = x^2-6x+9$$

$$0 = x^2-5x+4$$

$$0 = (x-4)(x-1)$$

$$\boxed{x=4} \text{ or } x=1 \text{ Doesn't check}$$

26. $x^2 + 26 = -10x$

$$x^2 + 10x + 26 = 0$$

$$x = \frac{-10 \pm \sqrt{100 - 4(1)(26)}}{2(1)}$$

$$x = \frac{-10 \pm \sqrt{-4}}{2} = \frac{-10 \pm 2i}{2}$$

$$= \boxed{-5 \pm i}$$

27. $(\sqrt[3]{2-x})^3 = (-2)^3$

$$2-x = -8$$

$$-x = -10$$

$$\boxed{x = 10}$$

Application Problems. For all problems where an equation is not given, you need to define your variable(s), set up an algebraic equation or equations, solve algebraically, and answer the question with the proper units. If an equation is given, be sure to answer the question completely and with proper units. (4 pts each)

28. Suppose that a flare is launched upward with an initial velocity of 64 ft/sec from a height of 80 ft. Its height, $h(t)$, in feet, after t seconds is given by

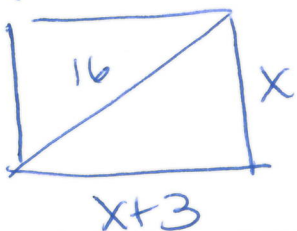
$$h(t) = -16t^2 + 64t + 80$$

After how long with the flare reach the ground?

$$\begin{aligned} -16t^2 + 64t + 80 &= 0 \\ -16(t^2 - 4t - 5) &= 0 \\ -16(t-5)(t+1) &= 0 \\ t &= 5 \text{ or } t = -1 \end{aligned}$$

Will reach ground after 5 sec.

29. A rectangular garden is 3 feet longer than it is wide. Determine the dimensions of the garden if it measures 16 ft. diagonally. (round to nearest tenth) $x = \text{width}$
 $x + 3 = \text{length}$



width = 9.7 ft
 Length = 12.7 ft

$$\begin{aligned} x^2 + (x+3)^2 &= 16^2 \\ x^2 + x^2 + 6x + 9 &= 256 \\ 2x^2 + 6x - 247 &= 0 \\ x &= \frac{-6 \pm \sqrt{36 - 4(-247)(2)}}{2(2)} = 9.7 \text{ or } -12.7 \end{aligned}$$

30. Nick can write an exam three times as fast as Hendree can. If they work together it takes them 3 hours. How long would it take each of them to write the exam alone?

$x = \text{time it takes Nick}$
 $3x = \text{time it takes Hendree}$

$$\begin{aligned} \frac{3x}{1} \cdot \frac{3}{x} + \frac{3 \cdot 3x}{3x \cdot 1} &= 1 \cdot 3x \\ 9 + 3 &= 3x \\ 12 &= 3x \\ 4 &= x \end{aligned}$$

Takes Nick
 4 hrs
 Take Hendree
 12 hrs

31. A loaded Roadway truck is moving 40 mph faster than a New York Railways Freight Train. In the time that takes the train to travel 150 miles, the truck travels 350 miles. Find the speed of both the truck and the train.

$D = r \cdot t$

Roadway	350	$r+40$	t
NY Railway	150	r	t

$t = \frac{350}{r+40}$ $\frac{350}{r+40} = \frac{150}{r}$
 $t = \frac{150}{r}$ $350r = 150(r+40)$
 $350r = 150r + 6000$
 $200r = 6000$
 $r = 30$

truck = 70 mph
train = 30 mph

32. Lia sent 384 text messages in 8 days. At this rate, how many text messages would Lia send in 30 days?

$$\frac{384 \text{ texts}}{8 \text{ days}} = \frac{x \text{ texts}}{30 \text{ days}}$$

$$8x = 11520$$

$$x = 1440 \text{ texts}$$

33. Ted invests \$5000 in account that earns interest and is compounded annually. After 2 years his investment has grown to \$5512.50. What was the interest rate on the account?

$$\frac{5512.50}{5000} = \frac{5000(1+r)^2}{5000}$$

$$\sqrt{1.1025} = \sqrt{(1+r)^2}$$

$$1.05 = 1+r$$

$$r = .05$$

$$5\%$$

Bonus (3pts): Name a two digit number that is the square of its units digit.

25 or 36

Have a wonderful break!

