(1) The solution(s) to $\sqrt{x-3} = x - 5$ lie in the interval
   (a) (3,4)    (b) (4.01,5)    (c) (5.01,6)    (d) (6.01,8)    (e) (8.01,100)
   Answer: isolate sqrt, square both sides: $x - 3 = x^2 - 10x + 25$, all to one side: $0 = x^2 - 11x + 28 = (x - 7)(x - 4)$. So 7 and 4 seem like solutions BUT sub in x=4 and even though it makes inside of sqrt positive it is still not a solution because right side is negative. So, the only solution is $x=7$.

(2) Factor $8x^3 + 125$
   (a) $(4x - 5y)^2$  (b) $(2x + 5)(4x^2 - 10x + 25)$  (c) $(2x - 5)^3$  (d) $4x^2 + 25(2x + 5)$  (e) prime
   Answer: sum of cubes $A^3 + B^3$ factors as $(A + B) * (A^2 - AB + B^2)$

(3) What is the product of the solution(s) to $|x| + 3 = 5$?
   (a) 0  (b) 4  (c) 16  (d) -4  (e) -12
   Answer: rewrite as $x + 5 = -3$ and $x + 5 = 3$, hence $x = -8$; $x = -2$

(4) Find the inverse $f^{-1}(x)$ where $f(x) = \frac{4x - 5}{6}$
   (a) $-\frac{6}{3x - 5}$  (b) $2x + 10$  (c) $18x + 15$  (d) $\frac{3x + 5}{6}$  (e) 9
   Answer: Set $y = f(x)$; reverse $x, y$ to get $x = \frac{4y - 5}{6}$; then $6x = \frac{1}{3}y - 5$; then $6x + 5 = \frac{1}{3}y$, so $y = 18x + 15$.

(5) The sum of the solutions to $3x^2 + 5x - 12 = 0$ is:
   (a) 10  (b) 5  (c) $\frac{10}{3}$  (d) $-\frac{5}{3}$  (e) -10
   Answer: factors as $(3x-4)(x+3)=0$, so $x=4/3, -3$; sum is $-5/3$

(6) Solve the inequality $x^2 + x > 6$ in interval notation:
   (a) $(-\infty, -3) \cup (-3, 2) \cup (2, \infty)$  (b) $(-\infty, -3)$  (c) $(-\infty, -3) \cup (2, \infty)$  (d) $(-3, 2)$  (e) $(-2, \infty)$
   Answer: put in form $x^2 + x - 6 > 0$; factor $(x + 3)(x - 2) > 0$; boundary points are -3,2; so test intervals are $(-\infty, -3), (-3, 2), (2, \infty)$. Test points could be -4, 0, 3, sub into $(x+3)(x-2)$ to get 6; -6; 6 respectively, hence answer is $(-\infty, -3) \cup (2, \infty)$.

(7) Solve $|3x - 4| \leq 5$:
   (a) $x \leq -3$  (b) $-3 \leq x \leq 3$  (c) $x \leq -1/3$  (d) $-1/3 \leq x \leq 3$  (e) $x \leq 3$
   Answer: rewrite as $-5 \leq 3x - 4 \leq 5$. add $4 -1 \leq 3x \leq 9$; divide by 3; $-1/3 \leq x \leq 3$.

(8) The area of a rectangle is 54 square feet. The length is 3 feet more than twice the width. Find the perimeter in feet:
   (a) 33  (b) 33/2  (c) 30  (d) 15  (e) 27
   Answer: let $y$ denote the length and $x$ the width. Thus $y = 3+2x$ (length is 3 more than twice width). Since 54=x*y, we have 54 = $x*(3+2x)$ and we must solve for $x$: $0 = 2x^2 + 3x - 54 = (2x - 9)(x + 6)$. Only positive solution is $x = 9/2$; so $y = 3+9 = 12$; so perimeter is $2x + 2y = 9 + 24 = 33$.

(9) Solve $\frac{1}{x - 1} + \frac{2x}{2x + 1} = 1$:
   (a) 2  (b) 0  (c) 3  (d) -3  (e) -2
   Answer: multiply by $(x-1)(2x+1)$ to get $(2x + 1) + 2x(x - 1) = (x - 1)(2x + 1)$; simplify $2x^2 + 1 = 2x^2 - x - 1$ or $2 = -x$ hence $x=-2$.

(10) The x value for the solution to the system
   \[\begin{align*}
   3x - 5y &= 4 \\
   2x - 5y &= 1
   \end{align*}\]
   is:
   (a) 1  (b) -2  (c) 3  (d) -4  (e) 5
   Answer: multiply second equation by -1 to get opposite y’s
   \[\begin{align*}
   3x - 5y &= 4 \\
   -2x + 5y &= -1
   \end{align*}\] and add $x = 4 - 1 = 3$
(11) The distance from (2,-1) to (-1,3) is:
   (a) 1  (b) 13  (c) \sqrt{13}  (d) 5  (e) 25
   Answer: distance formula \sqrt{(2 - (-1))^2 + (-1 - (-3))^2} = \sqrt{9 + 16} = 5

(12) Solve 3x + 7 ≤ x - 4:
   (a) [11/2, ∞)  (b) (-∞, 7/2]  (c) [-11/2, ∞)  (d) (-∞, -11/2]  (e) [-3/2, ∞)
   Answer: rewrite as 2x ≤ -7 - 4, hence 2x ≤ -11 or x ≤ -11/2, so (-∞, -11/2).

(13) The slope of the line passing through (-1,1) and (3,-4) is
   Answer: use slope formula: slope = \frac{-4 - 1}{3 - (-1)} = \frac{-5}{4}

(14) Find f(g(5)) where f(x) = 2x + 3 and g(x) = -x + 1:
   (a) -12  (b) -52  (c) 9  (d) -5  (e) -9
   Answer: g(5) is -5+1 = -4; so f(g(5)) = f(-4) = 2(-4) + 3 = -5

(15) A line has slope 2 and goes through midpoint of line joining the line segment from (2,0) to (6,-8),
   the equation is:
   (a) y=2x-4  (b) y=2x-8  (c) y=2x-12  (d) y=2x-16
   Answer: midpoint is \left(\frac{2+6}{2}, \frac{0+(-8)}{2}\right) = (4,-4) and slope 2, means y-(-4) = 2(x-4) or y=2x-4.

(16) The graph of the equation x^2 - 8x + 9y + 2y = -13 is:
   (a) a circle with center (4,-1) and radius 4  (b) a parabola with vertex (4,-1)  (c) a circle with center (4,-1) and radius 2  (d) a straight line  (e) a parabola with vertex (-4,1)
   Answer: This is a circle and we need to complete the squares (adding (b/2)^2):
   x^2 - 8x + 16 + 9y + 2y + 1 = -13 + 16 + 1 hence (x - 4)^2 + (y + 1)^2 = 4 so center is (4,-1) and radius is 2

(17) The domain of f(x) = \frac{2x+6}{x^2-16} is the set of reals x such that:
   (a) x \neq -3  (b) x \neq \pm 4  (c) -4 < x < 4  (d) x \neq \pm 4 and x \neq -3  (e) x > 4
   Answer: denominator can’t be 0, so x \neq \pm 4

(18) what is the slope of the line which is perpendicular to 2x+3y=6:
   (a) \frac{3}{2}  (b) -\frac{3}{2}  (c) \frac{2}{3}  (d) -\frac{2}{3}  (e) -\frac{1}{2}
   Answer: negative inverse of slope of 2x+3y=6. find this slope by rewriting in y=mx+b form; y = -\frac{2}{3} x + 2, so the slope we want is +\frac{3}{2}

(19) What’s the remainder when dividing x+1 into x^4 - 3x^3 + 2x - 5:
   (a) -5  (b) -3  (c) -3x^3 + 2x - 5  (d) -1  (e) 0
   Answer: could use synthetic division: -1 | 1 -3 0 2 -5 or use that remainder is f(-1) = (-1)^4 - 3(-1)^3 + 2(-1) - 5 = -3

(20) The graph of y = log (x - 4) - 3 can be obtained from the graph of y = log x by shifting it:
   (a) right by 4 up by 3  (b) left by 4 down by 3  (c) right by 4 down by 3  (d) right by 3 down by 4  (e) right by 7
   Answer: this of the form f(x - 4) - 3 so it is shifted right by 4 then down by 3

(21) The y-intercepts and x-intercepts of y = x^2 - x - 6 listed in that order are:
   (a) -6,-2,3  (b) 6,-3,2  (c)-3,2,6  (d) 0,6  (e) don't know
   Answer: y-intercept sub in x=0 to get y=-6; x-intercept(s) sub in y=0 and solve 0 = x^2 - x - 6 = (x - 3)(x + 2), i.e. -2,3.

(22) The y value of the vertex of f(x) = -x^2 + 4x + 3 is:
(a) 4    (b) -9    (c) 3    (d) 4    (e) 7
Answer: vertex is \(-\frac{b}{2a}, f(-\frac{b}{2a})\), hence x-value is 2, so y-value is \(f(2) = -2^2 + 4(2) + 3 = 7\).

(23) The equation of the horizontal asymptote of \(f(x) = \frac{2x^3 - 4x^2 + 7}{x^3 - 27}\) is:
(a) \(y = 2\)    (b) \(x = 3\)    (c) \(y = 0\)    (d) \(x = 2\)    (e) no horizontal asymptote
Answer: Degree in numerator is same as denominator, thus \(y = \frac{2}{1} = 2\).

(24) Solve for \(y\) in the equation \(8a y - 9x = 11\)
(a) \(\frac{8ay-9x}{22}\)    (b) \(\frac{9x}{8a-22}\)    (c) \(\sqrt{9x + 8a}\)    (d) \(4a - \frac{2x}{9}\)    (e) \(5ax\)
Answer: get all \(y\)'s on left side: \(8ay - 9x = 2y \cdot 11\), hence \(8ay - 22y = 9x\), or \(y \cdot (8a - 22) = 9x\), so \(y = \frac{9x}{8a-22}\).

(25) Five thousand dollars is invested at 8% compounded monthly, what will the account be worth in 5 years?
(a) 5416.44    (b) 7449.23    (c) 7459.12    (d) 8080.37    (e) 506285.32
Answer: use \(A = P \left(1 + \frac{r}{12}\right)^{12 \times t}\), hence \(A = 5000 \times (1.00667)^{60} = 7449.12\)

(26) Solve with exact answer: \(10^{2x} = 7\), \(x = \frac{1}{2} \log_{10} 7\)
(a) \(\frac{1}{2} \log_{10} 7\)    (b) \(\log_{10} 3.5\)    (c) \(10^{7/2}\)    (d) \(\log_{10} 7 - 2\)    (e) \(\log_{10} \frac{14}{10}\)
Answer: \(x\) in exponent so take log base 10 which is same as converting to log form: \(2x = \log 7\), thus \(x = \frac{\log 7}{2}\).

(27) Solve \(4^{x+1} = 2^{3x}\):  
(a) -2    (b) 0    (c) 1    (d) 2    (e) no solution
Answer: obviously work in base 2, so rewrite as \(2^{2x+2} = 2^{3x}\), hence \(2(x+1) = 3x\), so \(2 = x\).

(28) the domain of \(f(x) = \ln (7 - 2x)\) is
(a) \(x \geq 3.5\)    (b) \(x > 3.5\)    (c) \(x < 3.5\)    (d) \(x > 5\)    (e) \(x > 0\)
Answer: Inside of log must be greater than 0, so \(7 - 2x > 0\) and solve as in \(7 > 2x\), or \(7/2 > x\), hence \(x < 7/2\).

(29) Solve \(3 + \log_3(4x + 1) = 5\)
(a) -2    (b) 2    (c) \(\frac{1}{3}\)    (d) \(\frac{3}{4}\)    (e) no solution
Answer: isolate log, then exponentiate: \(\log_3(4x + 1) = 2\), so 3 to the power of both sides: \(4x + 1 = 9\), hence \(4x = 8\), or \(x = 2\).

(30) Combine into one log: \(\ln(x - 3) + 2 \ln(x) - \ln(4x + 5)\)
(a) \(\ln(x^3 - 3x^2)\)    (b) \(\ln(x^2 - 3x - 8)\)    (c) \(\ln(\frac{x^2 + x - 3}{2x + 5})\)    (d) \(\ln(-x - 8)\)    (e) \(\ln\left(\frac{x^3 - 3x^2}{4x + 5}\right)\)
Answer: \(\ln((x-3) + \ln(x^2) - \ln(4x+5))\) by power rule, then by product rule \(\ln((x-3) \cdot x^2) - \ln(4x+5)\), finally \(\ln\left(\frac{(x-3)x^2}{4x+5}\right)\) by quotient rule.

(31) The number of watts, \(W\), on a space satellite’s power supply after \(d\) days is given by \(W = 80e^{-0.0004d}\). How long in days until the power drops to 25 watts?
(a) 7    (b) 184    (c) 1837    (d) 2901    (e) 2908
Answer: Simply set \(25 = 80e^{-0.0004d}\) and solve for \(d\). We divide by 80, then take ln of both sides: \(\ln(25/80) = -0.0004d\), thus \(d = \ln(25/80)/(\ln(0.0004)) = 2907.87\).