MPM2D
April 29, 2019

KNOWLEDGE (KU)		42
APPLICATION (AP)		/18
THINKING (TI)		/16
COMMUNICATION (CO)		level

Name: ANSWERS

Test #4 Quadratic Equations

Knowledge & Understanding (KU)

1. Determine the roots for each of the following by factoring.

Out of 16

a.) $6x^2 - 11x - 10 = 0$

$P = -60$, $S = -11$

$-15, 4$

$\frac{-15}{6}, \frac{4}{6}$

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

$x = \frac{5}{2}$ $\quad x = \frac{-2}{3}$

b.) $(x + 10)(x + 8) = 0$

$x = -10$ $\quad x = -8$

c.) $2x^2 - 9x = 5$

$2x^2 - 9x - 5 = 0$ $\quad P = -10$, $S = -9$

$\frac{-10}{2}, \frac{1}{2}$

$(x-5)(2x+1) = 0$

$x = 5$ $\quad x = -\frac{1}{2}$

d.) $2x(x + 4) = x + 4$

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

$2x^2 + 8x - x - 4 = 0$

$2x^2 + 7x - 4 = 0$ $\quad P = -8$, $S = 7$

$\frac{-1}{2}, \frac{8}{2}$

$(2x-1)(x+4) = 0$

$x = \frac{1}{2}$ $\quad x = -4$

2. Determine the roots for the following by using the quadratic formula.

$(x + 4)^2 = 2(x + 5)$

$x^2 + 8x + 16 = 2x + 10$

$x^2 + 8x - 2x + 16 - 10 = 0$

$x^2 + 6x + 6 = 0$

$a = 1 \quad b = 6 \quad c = 6$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(6) \pm \sqrt{(6)^2 - 4(1)(6)}}{2(1)}$

$x = \frac{-6 \pm \sqrt{12}}{2}$

$x_1 = \frac{-6 + \sqrt{12}}{2}$ $\quad x_2 = \frac{-6 - \sqrt{12}}{2}$

$x_1 = -1.27$ $\quad x_2 = -4.73$

Out of 6

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3. Use the discriminant to determine the number of real solutions that each equation has.

a.) $x^2 + 3x - 5 = 0$

$a=1 \quad b=3 \quad c=-5$ ✓

$b^2 - 4ac$

$(3)^2 - 4(1)(-5)$ ✓

$29 > 0$

$\therefore$ 2 roots ✓

b.) $-17x - 9 = 4x^2 - 5x$

$4x^2 - 17x + 5x - 9 = 0$ ✓

$-4x^2 - 12x - 9 = 0$

$a=-4 \quad b=-12 \quad c=-9$ ✓

$b^2 - 4ac$

$(-12)^2 - 4(-4)(-9)$ ✓

$0 = 0$

1 root ✓

Out of 7

4. Determine whether the vertex of the parabola lies above, below, or on the x-axis. Explain how you know. (Hint: use the discriminant)

$h = 5t^2 - 30t + 45$

$\frac{0}{5} = \frac{5t^2}{5} - \frac{30t}{5} + \frac{45}{5}$ ✓

$0 = t^2 - 6t + 9$

$a=1 \quad b=-6 \quad c=9$ ✓

$b^2 - 4ac$

$(-6)^2 - 4(1)(9)$ ✓

$0 = 0$

$\therefore$ 1 root ✓

$\therefore$ the vertex will be on the x-axis ✓

Out of 5

5. Determine whether the given value is a root of the equation.

a.) $x = 2; x^2 + x - 6 = 0$

$(2)^2 + (2) - 6 = 0$ ✓

$0 = 0$ ✓

$\therefore x = 2$ is a root ✓

b.) $x = 4; x^2 + 7x - 8 = 0$

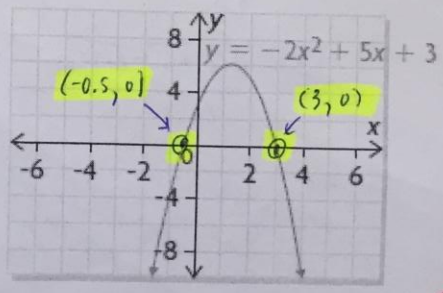
$(4)^2 + 7(4) - 8 = 0$ ✓

$36 \neq 0$ ✓

$\therefore x = 4$ is not a root ✓

Out of 6

6. Use the graph of quadratic relation to determine the roots to each quadratic equation, where y = 0.



roots are -0.5 & 3 ✓ ✓

Out of 2

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Application (AP)

1. The user's manual for Arleen's model rocket says that the equation $h = -5t^2 + 40t$ models the approximate height, in metres, of the rocket after t seconds. When will Arleen's rocket reach a height of 60 m? (Hint: solve by factoring)

$h = 60$

$60 = -5t^2 + 40t$ ✓

$\frac{0}{-5} = \frac{-5t^2}{-5} + \frac{40t}{-5} - \frac{60}{-5}$

$0 = t^2 - 8t + 12$ ✓ $P = 12$, $S = 8$, $-2, -6$

$0 = (t-2)(t-6)$ ✓

$t = 2$ $t = 6$ ✓

✓

∴ the rocket will reach 60 m at 2 s and 6 s ✓

Out of 6

2. A model rocket is shot straight up from the roof of a school. The height, h, in metres, after t seconds can be approximated by $h = 15 + 22t - 5t^2$ → $h = -5t^2 + 22t + 15$

a.) What is the height of the school?
b.) When does the rocket hit the ground? (Hint: solve by quadratic formula)
c.) What is the maximum height of the rocket?

a.) $t = 0$

$h = -5(0)^2 + 22(0) + 15$ ✓

$h = 15$ m ✓

∴ the school is 15 m high ✓

b.) $h = 0$

$0 = -5t^2 + 22t + 15$ ✓

$a = -5$ $b = 22$ $c = 15$ ✓

$t = \frac{-(22) \pm \sqrt{(22)^2 - 4(-5)(15)}}{2(-5)}$

$t = \frac{-22 \pm \sqrt{784}}{-10}$ ✓

$t = \frac{-22 \pm 28}{-10}$

$t_1 = \frac{-22 + 28}{-10}$ ✓ $t_2 = \frac{-22 - 28}{-10}$

$t_1 = -0.6$ ignore $t_2 = 5$ ✓

∴ the rocket will hit the ground after 5 s ✓

c.) x of the vertex $\frac{-0.6 + 5}{2} = 2.2$ ✓

y of the vertex $h = -5(2.2)^2 + 22(2.2) + 15$

$h = 39.2$ m ✓

∴ the max height of the rocket is 39.2 m ✓

Out of 12

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Thinking & Inquiry (TI)

1. Determine the points of intersection of the line $y = -2x + 7$ and the parabola $y = 2x^2 + 3x - 5$.

P.O.I. ① ②

Sub ① into ②

$-2x+7 = 2x^2+3x-5$ ✓

$0 = 2x^2+3x+2x-5-7$

$0 = 2x^2+5x-12$ ✓

$0 = (2x-3)(x+4)$ ✓

$x = 1.5$ $\quad x = -4$

$p = -24$, $s = 5$: $-3, 8$ (÷2) → $-4, 1$ ✓

sub $x = 1.5$ & $x = -4$ into ①

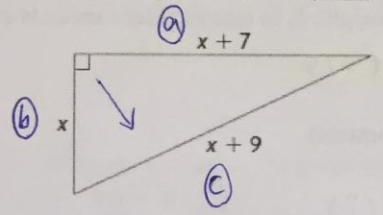
$y = -2(1.5)+7$ ✓ $\quad y = -3+7$ $\quad y = 4$ ✓

$y = -2(-4)+7$ ✓ $\quad y = 8+7$ $\quad y = 15$ ✓

∴ P.O.I.'s are $(1.5, 4)$ & $(-4, 15)$ ✓

Out of 10

2. Calculate the value of x. (Hint: $a^2 + b^2 = c^2$)



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

$(x+7)^2+(x)^2=(x+9)^2$ ✓

$x^2+14x+49+x^2 = x^2+18x+81$ ✓

$x^2+x^2-x^2+14x-18x+49-81=0$

$x^2-4x-32=0$ ✓ $\quad p = -32$

$(x-8)(x+4)=0$ ✓ $\quad s = -4$: $-8, 4$

$x = 8$ ✓ $\quad x = -4$ ✓ ignore

Out of 6

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