ODE HW 6.1, 6.2

Greyson Knippel
MATH 260-1 — Gonzaga University
Professor Jensen

February 14, 2026

euler's method

ODE: $z' = x - 2z$, $z(0) = 1$, $h = 0.1$

k	x_k	z_k	$f(x_k, z_k)$	$f \cdot h$	z_{k+1}
0	0.0	1.0000	-2.0000	-0.2000	0.8000
1	0.1	0.8000	-1.5000	-0.1500	0.6500
2	0.2	0.6500	-1.1000	-0.1100	0.5400
3	0.3	0.5400	-0.7800	-0.0780	0.4620
4	0.4	0.4620	-0.5240	-0.0524	0.4096
5	0.5	0.4096	—	—	—

code:

```

# euler's method
x = 0.0
z = 1.0
h = 0.1
steps = 5

for k in range(steps):
    f = x - 2*z
    f_times_h = f * h
    z_next = z + f_times_h

    print(f"{k:<5} {x:<8.1f} {z:<8.4f} {f:<12.4f} #table variables
          {f_times_h:<10.4f} {z_next:<8.4f}")

    x = x + h
    z = z_next
```

RK2 midpoint method

ODE: $z' = x - 2z$, $z(0) = 1$, $h = 0.1$

k	x_k	z_k	k_1	k_2	z_{k+1}
0	0.0	1.0000	-2.0000	-1.7500	0.8250
1	0.1	0.8250	-1.5500	-1.3450	0.6905
2	0.2	0.6905	-1.1810	-1.0129	0.5892
3	0.3	0.5892	-0.8784	-0.7406	0.5152
4	0.4	0.5152	-0.6304	-0.5174	0.4578
5	0.5	0.4578	—	—	—

code:

```
# RK2 midpoint method
x = 0.0
z = 1.0
h = 0.1
steps = 5

for k in range(steps):
    k1 = x - 2*z
    k2 = (x + h/2) - 2*(z + k1*h/2)
    z_next = z + k2*h

    print(f"{k:<5} {x:<8.1f} {z:<10.4f} {k1:<10.4f} #table variables
          {k2:<10.4f} {z_next:<10.4f}")

    x = x + h
    z = z_next
```

made in python 3.13.7